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INSULATION AND GROUND CONNECTIONS.

There is a notable difference between English and American practice in the wiring of electric lighting systems, particularly that of alternating-current, constant-potential, transformer installations. American practice universally favors the uniform insulation of both sides of the primary, and also of the secondary system from ground connection, while the English frequently ground one side of the primary system, and either ground their secondaries or provide them with automatic earthing devices. A consideration of which practice is the better of the two involves the question of the fundamental purposes of insulation. There may be considered to be two of these, first, the protection of the circuits from leakage or short circuit, and second, the protection of all persons from serious electrical shock.

For the latter purpose the English practice seems to have an advantage. If the insulation resistance between the primary and secondary coils of a transformer breaks down at one point there is in American practice no indication given of the dangerous voltage likely to exist between the secondary circuit and the earth in case of any ground at any other part of the primary system. Sockets are notably defective devices, and anyone working in basements or damp grounded places with hand lamps may obtain in this way a fatal shock at any time. With the English arrangement, on the contrary, there is no possibility of getting a high voltage between the secondary wiring system and the ground, because the two are short-circuited at all times. In case of any breakdown of the insulation between the primary and secondary, if it is on the grounded side of the primary, there is, of course, no effect and no danger, these two parts being already connected. If on the other side a short circuit is caused, blowing out the primary service fuses, and thereby giving instant indication of the trouble.

With regard to the prevention of leakage, and particularly of short circuits, it seems of course at first sight as though the insulation of each side of a circuit from ground gives a sort of double protection, a simultaneous grounding at two points on opposite sides of the system being necessary to cause a short circuit. In a sense this is true, but, looked at from another standpoint, the ground is a conducting network intermeshed with the two sides of the electrical system, the insulation thickness between either side and the ground being one-half that between the two sides. If the current leaks through this half-thickness of the insulation at any one point it is instantly connected by the ground to any point at which the insulation of the other side of the circuit may be weak, there to effect a breakdown if possible. If, on the contrary, one side of the circuit is grounded at all points, all the insulation being inserted between the ground and the other side as in ordinary traction work, there is no intermeshed conductor connecting intermediate points of all the insulating parts. For this reason weak points in the insulation are not cross-connected with each other, as in the other system.

There may be applied to this case a modern and revised version of an old piece of advice that reads in its revised form as follows: "Put all your eggs in one basket, and then watch that basket." In wiring systems, put all your insulation on one side, and watch that side.

ANOTHER TROLLEY DECISION.

The litigation carried on during the last few years on the claims of the Van Depoele patent, No. 495,443, has been so extensive that it is difficult to keep track of the situation. A new move has lately been made by the preliminary injunction filed February 7 by Judge Lacombe in the United States Circuit Court, as mentioned in the last issue of The Electrical World. The case was brought by the Thomson-Houston Electric Company, plaintiff, against the Union Railway Company, nominal defendant, the Walker Company, of course, being the real defendant. To understand the bearing of this injunction it is necessary to consider a few of the previous steps. The Winchester Avenue case decided by Judge Townsend in January, 1896, upheld various claims of this same patent, making no mention, however, of claims 2 and 4, which are involved in the opinion just rendered. The claims upheld in the Winchester Avenue case involve, among other things, the combination of a trolley pole and springs or weights or weighted springs for pressing it upward against the overhead conductor, but do not broadly claim a pole with or without springs or weights for upholding the contact against the overhead wire, as do the two claims on which the latest opinion is based. A later decision of the Court of Appeals, known as the Hoosick Railway decision, rendered invalid the rights based on the claims combining a pole and devices for pressing it upward, owing to double patenting, as these combinations had been already patented by Van Depoele in his earlier patent No. 424,695.

The two claims declared on by Judge Lacombe February 7, 1898, are as follows:

"The combination of a car, an overhead conductor above the car, a contact device making underneath contact with the conductor and an arm carried by the car and carrying the contact device, and pivoted so as to swing freely around a vertical axis.

"The combination of a car, an overhead conductor above the car, a contact device making underneath contact with the conductor, and an arm on the car movable on both a vertical and a transverse axis and carrying the contact device."

The opinion holds virtually that although the Winchester Avenue decision was not precisely based on this combination, in which springs or weights are not specified, still this simple combination without these accessories was held to be a most meritorious invention and Van Depoele its inventor. In other words, Van Depoele was the first to make practicable the electrical connection to a car through "a long rigid arm upwardly pressed and capable of universal movement." The Walker Company in its defense contends that the weight or spring must be assumed in this combination, for without it the device would be inoperative and therefore unpatentable and useless, and if so assumed the claims become, like the other claims of the same patent, invalid through double patenting. The interesting answer of Judge Lacombe to this point is as follows: "Although an additional device may have to be added to make the combination operative *automatically*, it is none the less operative without such addition. A boy seated on the roof of the car could impart the upward pressure, not as economically nor as well as the weighted spring would, but quite sufficiently to insure the operation of the combination expressed in the claim." With reasoning such as this, it is, of course, a matter of personal opinion as to where the line can be drawn between an operative and an inoperative device, and it is understood that the Walker Company will further contest the opinion on this ground. For those interested in a more detailed account of this litigation a list of references to the columns of The Electrical World may be found among the Legal Notes in this issue.

ELECTRICAL MACHINERY IN SOUTH AMERICA.

There has been during the last few years a notable development of the export trade in the finer classes of machinery, particularly electrical machinery. Large orders of such apparatus are now shipped with great frequency even to England, a fact apparently as anomalous as "the shipping of coals to Newcastle." This is probably due to the fact that in spite of the higher wages paid in this country Yankee ingenuity and progressiveness have developed machines of greater simplicity and ease of construction, and methods of manufacture of greater economy, than those of the European nations. Every week shipments of American electrical machinery to Europe, Africa, Australia, China, Japan, and South America are recorded.

In another column will be found an interesting account by Mr. P. H. Thomas of a plant of American installation in Brazil, with some comments on the possibilities of trade with that country. Mr. Thomas, having visited Brazil as an engineer of an electrical corporation, is competent to speak on this subject. The difficulties in the way of the South American investor who aspires to the ownership of a satisfactory electrical installation are by no means slight. He knows in all probability nothing about the necessary apparatus or its installation, not even enough to give data to the manufacturing and supply companies as to what he wants. Not only are consulting engineers few and far between, but linemen and electricians sufficiently experienced to run a dynamo and keep it in repair are scarce. American banks are but poorly represented in South America. Tariffs and the variable rate of exchange and the poor financial credit of South American business men, combined with the difference in language, render negotiations difficult. The question that arises in the mind of the average purchaser, therefore, is not what company makes the best or cheapest line of apparatus, but from what company can he get it at all, and how shall he order, and how shall the machines be shipped? It would seem as if an American electrical company, with an energetic agent on the ground, who could save the necessity of the customer himself sending 5000 miles for every slight item of supplies that might be needed, or for a man to straighten out troubles with the plant, would do considerable business in South America. In spite of the poor credit of some of these countries their natural resources are great and their need for imported machinery, although they may not realize it, is serious. The shrewd American business manager should certainly find a means of getting around the disadvantages, which are trifling compared with these fundamental facts in his favor.

ELECTRICAL EXPORTS TO JAPAN.

The Japanese are a people peculiarly different from all other races in their capacity for borrowing ideas and utilizing these solely for their own benefit. The industrial revolution in Japan has reached a stage of progressiveness as extreme as the former lethargy. The people are adopting the very latest and most modern practices of their neighbors of earlier development, and are rapidly teaching themselves to imitate the methods of others, so that they gain the advantages of years of progress without suffering the losses of pioneers. In the matter of machinery, and particularly that used in the electrical industry, they buy liberally at first the apparatus of America and Europe, but quickly learn to make it themselves and cut off foreign orders. The Japanese are clannish as a race and believe in home industry. It behooves foreigners, and particularly electrical houses intending to establish a trade in Japan, to protect themselves from this imitative tendency, and fortunately this can be done by the aid of the recently enacted agreement as to patents. Otherwise, the importing house will find a splendid business awaiting it at the start, followed by a dwindling one as soon as the natives can learn to build the same devices themselves.

A Submarine Conduit.

An interesting conduit has just been laid across the Harlem River at the crossing of Third Avenue, New York City, for carrying the cables of the American Telephone and Telegraph Company. The object of the construction, which is illustrated herewith, is to protect these cables and their containing pipes from the action of ice, from the anchoring of a vessel or any other disturbances.

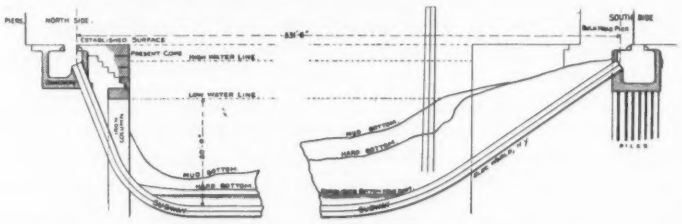
The width of the river, measured from manhole to manhole of the subway, is 531 feet 6 inches. The subway itself consists of eight wrought iron pipes of 4 inches internal diameter, encased in a structure of Georgia pine boards, the whole forming an elliptical cylinder about 26x23 inches. The pipes were specially treated by being coated inside with hot asphalt and externally with a coating about one-eighth inch thick of asphaltic rubber.

The main interest in this system centres in the method employed to put it in place. It was built on the south bank in three sections, a straight section in the middle and two curved sections for the ends where it rises from its position twenty feet below extreme low water line level to the manhole level above.

The Third Avenue bridge crossing the Harlem River is only a few feet east of the subway. From a point near the southern rest pier of this bridge, and extending back to a considerable distance on

THE THREE SECTIONS ON THE WAYS.

the shore, was erected a set of ways similar to those employed in the launching of ships. Upon these ways, and in proper cradles, the three sections of the conduit were constructed and prepared for launching. By the peculiar design of the conduit it was possible to make its specific gravity only a little greater than that of water and just sufficient to hold it firmly in place on the bottom of the river, and this, of course, greatly facilitated the launching and handling of the various sections. When all was ready, the first section (that intended for the north side of the river and containing the upward curve) was, by means of a windlass on the opposite shore, hauled down the ways until its southern end was flush with the northern end of the straight



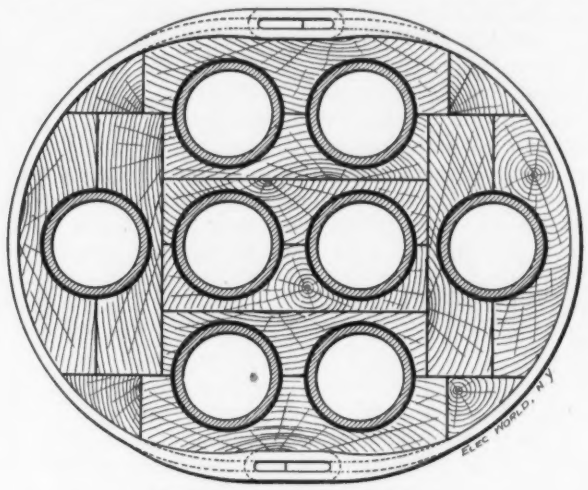
SECTION OF HARLEM RIVER, SHOWING CONDUIT IN PLACE

section to which it had to be joined. At this point a pile-driver scow lifted the front, or curved section, of the conduit so as to bring the rear end of it in line with the second or straight part, and the joint between these two was quickly made. This joint is very interesting. A cast-steel face plate was put over the ends of the abutting portions of the conduit and the duct tubes brought through it in proper holes. These were then upset into a chamber, made for that purpose, and

A SHARP CURVE.

the faces of the end plates smoothed off. The two were then brought tightly together by a system of wedges and keys, a thin sheet of the purest quality of india rubber being interposed. The juncture is entirely water tight and is very satisfactory. The joint once made, the whole conduit was hauled further down the ways and in due process the third section attached to the end of the second.

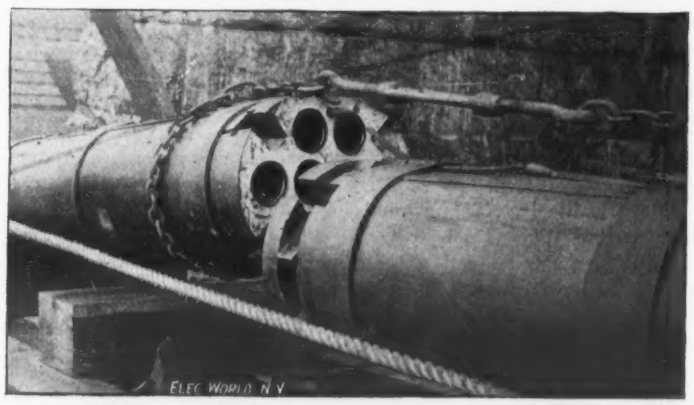
For the reception of the conduit a ditch had been dredged across the river through the soft mud and hard-pan bottom, and in some places through rock which had to be blasted. The middle and level part of the conduit lies 20 feet below extreme low water and about 2



CROSS SECTION OF CONDUIT.

feet below the bottom of the river level, as established by the War Department. It is interesting to note that this work was carried on without the employment of divers, and that none were used upon it, except to see that all was tight and sound after the conduit was in place in the river bottom. A set of special cables, each carrying 200 pairs of wires, is to be used in this conduit, the main lines of the Long-Distance Telephone Company of New York, north and eastward, passing through it.

The design of the conduit and its construction were the work of the Union Subway Construction Company, New York, whose engineers deserve great credit for their original and satisfactory solution of a somewhat difficult problem.



GETTING READY TO MAKE A JOINT.

Electric Transmission Plant at Juiz de Fora, Brazil.

BY PERCY H. THOMAS.

IT may not be generally known that our American manufacturing companies have supplied several electric plants, both for lighting and street railway service, for cities in Brazil. One of the pioneer plants of this country is that operated by the Companhia Mineira de Electricidade (the Electric Company of Minas), which owns the "concession" or franchise for lighting and power, as well as for telephone service, for the city of Juiz de Fora. The company has been operating about nine years, and has recently reconstructed its entire plant and enlarged the capacity. A new power house and distributing station have been built, and two 300-kw generators, with other apparatus, obtained from this country.

At present nearly all the power is used for street and house lighting, although the city contains several small manufacturing establishments, cotton cloth weaving, carpenter shops, machine shop, furniture making, printing, etc., many of which expect to use electric motors as soon as the power is available.

The city contains a short street car line, but the traffic does not seem sufficient at present to warrant the introduction of electric traction, although the use of a two-phase rotary for this purpose has been proposed.

Juiz de Fora has about 15,000 inhabitants, and is the largest and most important city of Minas Geraes, one of Brazil's twenty-two States. It is situated well in from the coast, about 150 miles north of Rio Janeiro, on the Central Railroad of Brazil.

As in many Brazilian towns the streets are very narrow, but Juiz de Fora is more fortunate than some of the older settlements in having some streets of very generous width. Narrow streets and low buildings make the problem of street lighting rather different from that in most of our cities, where wider streets and higher buildings are the rule. In Juiz de Fora 32-cp incandescent lamps are the standard for street lighting, and serve their purpose very well in many streets where arc lights would probably be too powerful. The lamps, 50 volts each, are connected twenty in series on 1000 volt mains.

In 1888 the Companhia Mineira de Electricidade opened operations by ordering two small Westinghouse 1000-volt alternators. These generators ran directly on the transmission line, which was about 4½ miles long. Twenty per cent. Stilwell regulators were used to raise the pressure. The generators and a small exciter were belted to a jack shaft, driven by Victor turbines. This use of 1000 volts for a 4½ mile transmission was certainly very inefficient and ill adapted to the maintenance of a constant potential at the lamps, but at the time that this plant was installed transmission plants were very few, and this was not considered bad practice.

Before long the load became too heavy for the generating apparatus and turbines, and in 1890 another generator, regulator, exciter and turbine were added, but the general plan and the voltage remained unchanged. The station again became fully loaded, and as the inefficiency of 1000-volt transmission had become evident it was decided to reconstruct the plant. About two years ago work was begun on a new power station further down the river, where about 5000 horse-power as a minimum is available. The power is derived from a series of rapids in the Parahyba, a small river which flows through Juiz de Fora and finally joins the Uruguay many miles south.

The head of water is 150 feet, giving a pressure of about 60 pounds per square inch. Owing to the rapid rise in the river bed above the dam it is impracticable to obtain any considerable storage of water, but it is said that even in a very dry season at least 5000 horse-power is always available. This should be sufficient for all the present needs of the city.

The natural formation of the hills makes the hydraulic work very simple. A short canal connecting with a steel pipe but one metre in diameter conveys the water from the dam to the generating station. The power house is built of stone after the Brazilian custom, and is quite attractive in appearance. It is laid out for three 300-kw generators, each to be direct connected to a 450-hp Victor turbine. The generators, made by the Westinghouse Company, are 400-volt, two-phase 18-pole machines, running at 400 revolutions, and supplying current at 7200 alternations per minute.

Excitation is obtained from a 125-volt 10-hp D. C. generator, belted directly to the generator shaft. The turbines, made by the Stilwell-Bierce & Smith-Vaile Company, have horizontal shafts, and are provided with regulators controlled by pendulum governors. The regulators do not work very satisfactory, and hand regulation is preferred.

There are two three-wire transmission lines, so that the generators need not be run in parallel. As soon as the load warrants the third machine will be added to the first two.

The switchboard is very simple, consisting of the usual marble panels, upon which are mounted ammeters, voltmeters and a single-pole quick break switch for each phase, and a four-pole switch to

View of Power House and Flume.

control the whole. The exciter rheostat, the face-plate of the generator rheostat, the field plugs, and pilot lamps are also mounted on the switchboard. This simplicity in all arrangements is especially desirable in a location like Juiz de Fora, where no electrical supplies can be obtained on short notice, and where experienced electricians are nearly unknown. It is very creditable that, after once installed, the handling of the electrical apparatus by those whose whole electrical experience has been gained at this station has given comparatively little trouble.

In a separate room behind the switchboard are placed the raising transformers, six in number, each of 50-kw capacity. Westinghouse oil insulated, two-phase, three-phase transformers are used, raising the 400 volts of the machine, two-phase, to 4000 volts for the line, three-phase. From the transformers the lines pass directly to the choke coils and to the first cross arm. The A. J. Wurts system of lightning protection is used, four choke coils being placed on each wire. Although very heavy thunderstorms are frequent during the rainy or hot season the apparatus has been perfectly protected.

The transmission lines are carried on iron poles with wooden cross arms. The difficulty of preserving wooden poles and the expense of standard iron poles, which is very great at that distance from the manufacturers of such articles, are avoided by the use of old street car rails, which serve the purpose perfectly. Locke triple petticoat glass insulators are used, and have given absolutely no trouble.

A ground return telephone circuit is run on the same poles, and comparatively little difficulty is experienced in its use.

The pole line is run across country as direct as possible, over high hills and through thick forest part of the way. The Parahyba River is crossed several times. Except along the river bank there is nothing approaching a graded road and the difficulties of erecting a pole line must compare in magnitude with those of some of the lines in our Western States.

The distributing station, located about a half mile from the business centre of the city, is a substantial and ornamental stone structure. In addition to the main hallway containing the switchboard are two office rooms, a store room, work room and transformer room. Also on the second floor are quarters for the telephone exchange. The high tension lines enter the rear end of the building and run through the choke coils and a three-pole, double-break, high-tension switch to the lowering transformers; which are connected to convert the three-phase 3200 volts of the transmission line to two-phase at 1000 or 400 volts for distribution.

The lighting load of the city is divided between three circuits, which run from the bus bars fed by the lowering transformers. Each of the three feeder circuits has a separate panel on the switchboard, with voltmeter, ammeter, compensator, Stilwell regulator face plate, main switch and fuses. The board contains also a five-plug receptacle and ground detector.

Each feeder circuit is independently regulated by a 20 per cent. up or down Stilwell regulator, the voltage at the lamps being indicated on the switchboard voltmeter by means of the compensator, the principle of whose action, probably well known to all, is the subtraction from the voltmeter reading of an amount proportionate to the load which represents the drop in the line.

On the switchboard is provided a fourth panel for motor service; 400 volts being the pressure chosen. Separate lowering transformers are used, similar, however, to those supplying the 1000-volt bus bars. The power panel contains circuit breakers, ammeters, voltmeters, fuses and a four-pole switch for controlling the four-wire two-phase circuits. Two-phase Tesla motors are used.

The incandescent lamps for street lighting are supported by gas pipe brackets from the poles carrying the feeders and distributing circuits, and are placed at varying intervals, according to the importance of the streets. The principal streets have lights on both sides; others usually on one side only. As stated above, the lamps are run twenty in series on 1000 volts, each lamp being shunted by a choke coil, so that if a lamp burns out the current is carried by its choke coil, and the other nineteen lamps burn as before.

Domestic light is sold both by contract and by meter. Shallenberger house meters are used. The rate charged is very low; 30 reis (about one-half cent) per lamp hour. With all electrical material obtained from Europe or the United States at great expense and after long delay, this seems a remarkably low price. However, lamps are sold by the company at about 50 cents a piece; and installation work, which is always done by the company, is correspondingly dear.

The plant runs from dusk to dawn, and remains shut down during the day. However, when the arrangements are complete for furnishing power the 400-volt mains will be run during the day.

Electric lights, railways, telephones, etc., are looked upon with great favor by the Brazilians, and are introduced in most of the more progressive communities. But the difficulties in the way of actual installation are very great. Until comparatively recently the business houses of this country have made no effort to assist any progressively inclined individual desiring to install a lighting plant, and it has been necessary for the latter to look up all the engineering data, etc., for himself, and order what machinery he wanted directly from the manufacturer. This usually meant a trip to the "States," involving much time and expense. The inconvenience of the long distance from the source of supplies will be evident when it is remembered that a month each way is required by the mails between New York and Juiz de Fora, and that all shipments of apparatus are very much slower. The difference in language between the two countries is a further difficulty.

In spite of these obstacles, however, many cities are provided with telephone exchanges, all the settled parts of the country are connected by telegraph, which is operated by the Government, and several lighting and power plants have been installed in Brazil.

At Rio de Janeiro are electric lights and two street railway lines. One of these climbs to a considerable height back of Rio among the hills to Santa Theresa, a suburb of Rio, to which many go every night to avoid the yellow fever, which is the terror of Rio de Janeiro. The curves and grades on this road are very difficult, but, of course, there is no snow or ice to contend with.

The city of Petropolis, the old home of the Emperor, and the present residence of all the diplomats, has recently been provided with electric lights, and Porto Allegro, down the coast from Rio Janeiro, has been supplied for some time.

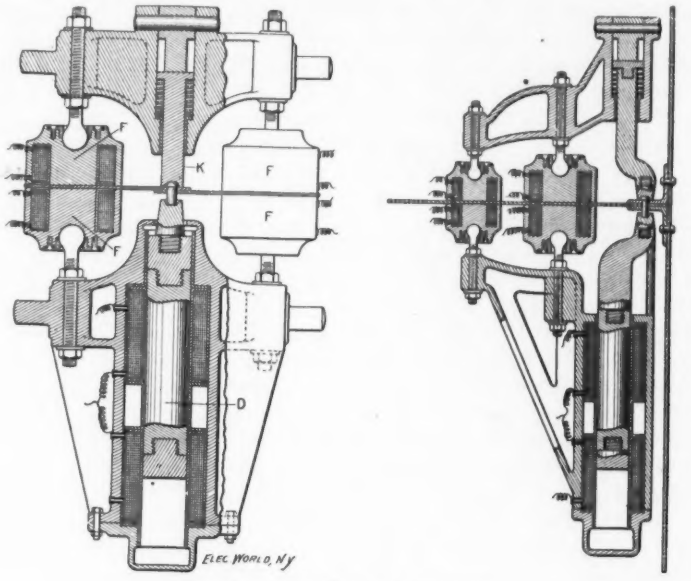
The State of Minas Geraes, in which is situated Juiz de Fora, is building a new capitol—not a new building merely, but a new city, laid out from beginning to end by Government engineers. This city, to be built on the site of the old village of Bello-Horynite, is designed for 30,000 inhabitants, and is to be lighted by electricity; the electric plant is practically a duplicate of that at Juiz de Fora, and Senhor Bernardo Mascarenhas, the president of the Companhia Mineira de Electricidade, is constructing engineer. This plant is laid out at present for two 300-kw generators, and 2000 volts instead of 1000 will be used for distribution.

The manufacturing companies of the United States stand very well in the estimation of the Brazilians, in comparison with their European rivals, and have supplied most of the larger installations. The plants at Juiz de Fora and Bello-Horynite are constructed by the Westinghouse Company; those at Rio Janeiro and Petropolis by the General Electric Company, and of those mentioned above only that at Porto Allegro is European. French machinery is there used, and is reported as unsatisfactory.

In the vigorous expansion of foreign trade that characterizes the present time, American manufacturing companies should be able to obtain considerable new work in the development of the numerous water powers of Brazil; and they will find that many electrical projects are ready to be undertaken as soon as satisfactory information descriptive of apparatus, etc., be given prospective purchasers, and as soon as competent engineers are stationed in the country to insure the running of plants.

Electric Riveting Machines.

An ingenious application of electricity to riveting machines was described in the issue of "L'Eclairage Electrique," for January 15, 1898. The machine illustrated is that known as the Morgan riveter, and two forms of it are shown in the accompanying illustrations, one for work on joints in flat surfaces and the other for use in angles and corners. The distinguishing peculiarity of these machines from other power riveters is the fact that they require no extended jaw



ELECTRIC RIVETING MACHINES.

to go around the edge of the plate in order to get the proper grip, and they can, therefore, work on surfaces at any distance from the edge or indeed between the inside and the outside of closed structures. The hold is obtained by powerful electromagnets *F F*, gripping the plate itself from either side. These are articulated on the frames of the two separate parts of the machine by ball and socket joints, as shown. The rivet head is held in a suitably shaped piece, *K*, while the other end is forced home by the plunger *D*, actuated by the solenoid, as shown.

In the form shown in the other illustration for working in corners the principle used is the same, the chief difference being that the riveting instead of being done between the two holding magnets is done off to one side, and therefore exerts a pull only on the one pair nearer the rivet, the other being pressed against the plate. One pair is, therefore, made much larger than the other. Other forms are described in the same article, using magnets for obtaining the hold and hydraulic pressure for forcing the rivet home.

The Diesel Heat Motor.

A new gas engine which has aroused a great deal of interest in continental Europe, owing to its radically novel principle and the remarkable results attained, was described in a paper read by Rudolph Diesel at a meeting of the Deutscher Ingenieure Verein, in June, 1897. The lecture is published in full and reprinted in pamphlet form by the Progressive Age Publishing Company, New York City, an abstract of the lecture and of the tests recorded by Prof. N. Schröter being as follows:

In the best triple expansion steam engine of over 1000 horse-power as developed up to the present day, only 12 or 13 per cent. of the heat energy contained in the fuel is converted into available work, less than 10 per cent. being developed from smaller sized compound engines, 5 per cent. from small condensing engines, and even less in ordinary units not very carefully handled. The losses occur at several points. In the first place, the efficiency of the boiler is below 80 per cent., generally about 75. The theory of the steam engine shows that only a part of the energy of the steam can be converted into work even in a perfect machine operating between given steam pressures. This ratio may be 30 per cent. in a good engine, but no engine ever indicates much more than one-half of this, and finally there are losses between the indicated power and the brake power.

In his experimental work in attempting to design a more simple and economical engine in which the combustion is effected within the working cylinder, Mr. Diesel set forth several conditions necessary of fulfillment. The first of these was that the temperature of combustion must be generated not by the burning of the fuel, but before, and independent of it by mechanical compression. A second condition was that the fuel must be introduced gradually into this compressed air in such a manner that the heat generated by gradual combustion shall give to the indicator card an admission line similar to that of the steam engine card, the point of cut off being imitated by the stopping of the fuel supply, the burnt gases then expanding adiabatically to the point of release, fresh air being compressed again up to the temperature of ignition for the introduction of the new charge. It is obvious that this is virtually a Carnot cycle, but it is necessary to deviate from a perfect cycle by expelling the expanded charge and taking in a new supply of air for compression, instead of isothermally giving heat to a continuously used charge of air from the walls of the receptacle at a high pressure, expanding it adiabatically, taking the waste heat isothermally from it at the lower pressure, and finally compressing it adiabatically to the temperature of the source of supply. Mr. Diesel also claimed that combustion should be carried on with a considerable surplus of air, the amount of which can be determined theoretically, instead of with as little surplus as possible. The accompanying diagram shows the ideal theoretic card and the card capable of practical realization. The long stretched out extremities are, of course, necessarily done away with in practice, owing to the difficulties involved by the high pressure of the one and the large cylinder dimensions of the other.

In such an engine there are great possible advantages of superiority over the steam engine. No steam boiler is used; there is, therefore, no loss of heat in the flue gases or by boiler radiation, nor steam pipe condensation. The maximum available theoretical efficiency for such a motor is greater than that of the steam engine, owing to the possibility of using higher pressures, and consequently a higher range of temperature. This theoretical efficiency varies from 50 to 70 per cent. There is no cylinder condensation, and several other sources of loss are abolished. The mechanical efficiency is, however, likely to be a little lower than that of the steam engine, owing to the high compression necessary and consequent transmission and retransmission of energy between the piston and the fly wheel.

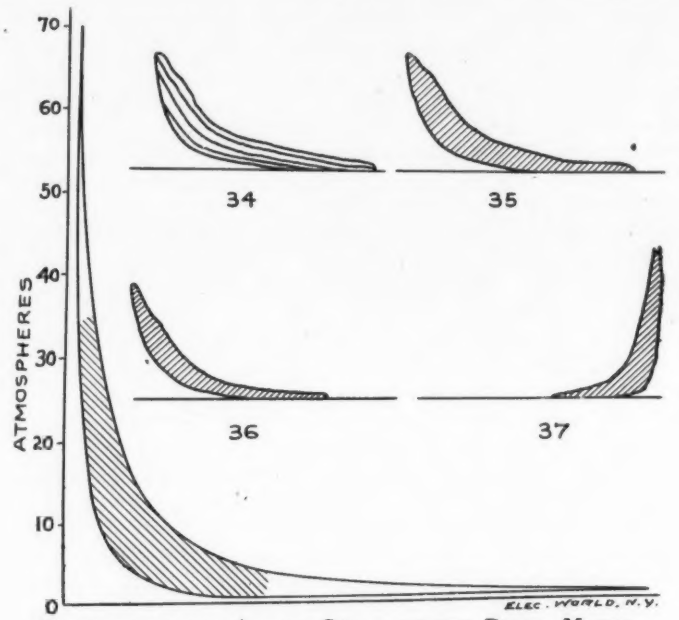
The experimental engines so far constructed have been of the single-cylinder four-cycle single-acting vertical type, one of which of 20 horse-power was tested with petroleum in the early part of 1897. This engine is provided with a ring piston and separate cross head, water-jacketed and provided with poppet valves operated by cams for admission and exhaust. A small pump is attached which keeps an auxiliary vessel filled with air compressed to a higher pressure than that obtained in the cylinder. This serves to inject the fuel, and also to start the engine. Actual cards from this engine are shown in the illustration, Nos. 34 to 37, the regulation for load changes being shown in one of the cards, indicating the close similarity with the steam engine. The cards appear narrow, but as compared with the combined cards of all the cylinders of a multiple expansion steam engine, the mean effective pressure is in reality high.

With this engine of 20 horse-power working with refined liquid petroleum, the maximum available theoretical efficiency was about 50 per cent. and the actual ratio of indicated energy to the total energy of the fuel was about 35 to 40 per cent., showing an indicated efficiency of the engine as such of 70 to 80 per cent. The mechanical losses of this engine varied between 25 and 30 per cent. on high loads, giving over 26 per cent. of the total heat of the fuel as available energy at the shaft. With reduced loads the mechanical efficiency, of course, falls off, but the thermal efficiency, owing to the greater expansion increases, thereby counterbalancing to a large extent the other and rendering the consumption of fuel per horse-power low at all but the lightest loads. Owing to the high pressure employed in this engine also, the cylinder dimensions are from 30 to 50 per cent. less than those of gas engines of the explosion type.

The governing of the speed is also as simple and easy as that of the steam engine. The exhaust gases are noticeably invisible and nearly odorless during ordinary running owing to the perfect combustion which also prevents fouling of the interior of the engine.

In a paper read before the same meeting by Professor Schröter, describing the tests made with the engine, the following facts were shown:

There was a noticeably exact regulation of the combustion process. One hundred and more diagrams were found to coincide ex-



Theoretical and Actual Cards of the Diesel Motor.

actly as with steam engines on constant load. The ratio of indicated work on compression to that of indicated work on expansion, average values for full and half load being taken, showed a value of about 50 per cent. The mean effective pressure in the working cylinder was about 7½ kilograms per square centimetre on full load, and 5¼ on half load, corresponding to 100 and 70 pounds per square inch. The effective work was measured by a modified prony brake. The mechanical efficiency, that is, the ratio of effective work to indicated work, varied from 75 per cent. to about 58 per cent., as the work was varied from full to half load. The consumption of petroleum per brake horse-power was about 0.24 kilogram on full load and 0.28 on half load. Careful tests were made of the calorific value of this fuel, showing that there was converted into brake horse-power over 25 per cent. of the available energy of the fuel at full load and over 22 per cent. at half-load.

The Diesel motor has been patented in all countries where patents are granted for inventions, and the rights for the United States and Canada have been acquired by a company, since incorporated under the laws of New York State, as the "Diesel Motor Company of America," with offices at 11 Broadway, New York. This company is controlled by powerful financial men, who are authorities for the statement that at Nuernberg, Diesel motors are being built at present for street cars and general railroad work, and Mirrlees, Watson & Yaryan, the marine engine builders, of Glasgow, are building reversible engines on the Diesel system, while European locomotive works are adapting the system for locomotives.

The Transformation of Energy in the Electric Arc.

On this much discussed subject the London *Electrical Review* makes the following powerful argument:

The mechanism of the conversion of electric energy into heat in the electric arc still evades the inquiries of experimenters, but papers are from time to time published dealing with the subject, and new suggestions made and new conclusions reached, without any conspicuous approach to an explanation of what occurs. Mrs. Ayrton's laborious and systematic observations are in recent years the most important of these contributions. Of course, "explanation" in such a case as this means no more than that the phenomena are shown to be subject to laws and conditions which are ascertained and well recognized in other cases, even though the mode of action in the latter may be quite obscure. The reference of the planetary motions, and the weight of terrestrial bodies, to one law of the attraction of gravitation is called an explanation of these phenomena, though the mode of attraction is not less obscure than the phenomena it explains, and the very idea of action at a distance may be abandoned as a misleading fiction. Following a course of this kind, one experimenter after another has attempted to find laws for the behavior of the electric current in the arc, similar to those which it obeys in a metallic conductor.

Electricity flowing through a metallic conductor generates heat at a rate proportional to the square of the current, and the independence of that coefficient, which is called the resistance, of the amount of current passing, is so conspicuous a property of metals and their alloys that it seems to indicate some marked characteristic in the mechanism of their conduction. So when a current of electricity flows through a junction of two different metals heat is developed, or absorbed, at a rate directly proportional to the current; and here again the coefficient involved, viz., the E. M. F. of contact, is a physical constant not less significant than the resistance. The molecular structure of metals is unaltered by the passage of the current, and no transfer of matter takes place.

This last property clearly differentiates the mode of conduction by metallic conductors from that by the arc, where disruption and transfer of matter occur. The *prima facie* improbability is very great that conduction by the arc is regulated by laws similar to the peculiarly exact and simple ones which apply to metallic conductors. All attempts to represent the heat developed in the arc as due to a resistance and a back E. M. F.—or, in other words, to express it as the sum of two terms containing the first and second powers of the current respectively—have been futile, and it appears unwise to persist in attacking the question on these or similar lines.

If the arc consists of molecules torn from the positive carbon, employed in the incessant to and fro bombardment of the poles, carrying positive charges to the negative, and negative charges to the positive carbon, the mode of transference of the charges is by convection and not by conduction; and an attempt to represent the action in terms of the ideas used for metallic conduction is analogous to an attempt to enter the statistics of a town supply by water carts on printed forms arranged for the data of a pipe supply.

An observation that under certain circumstances an increase of current in the arc is accompanied by a diminished potential difference between the carbons led the observer, drawing too closely the analogies with metallic conduction, to the absurd conclusion that the arc possesses negative resistance. No portion of the heat generated in the arc has been traced to a distinct cause involving transformation of energy proportional to the square of the current; and we have no ground for assigning resistance to the arc.

Professor Fleming, in a letter to the *Electrician* of January 7th, considers the probability of the existence of a "counter E. M. F. in the arc," and makes an interesting suggestion as to its possible source. It is not quite clear what idea is expressed by the words " counter E. M. F." They must mean something more than a means whereby electrical energy is converted into heat in direct proportion to the current, and seem to imply that the action is reversible, and to some extent elastic, so as to produce an E. M. F. in the reverse sense, if only for a very short time, on the sudden cessation of the main current. Such an action has been looked for repeatedly in the arc, but never, we believe, detected. It occurs in every other case we can call to mind, to which the term "counter E. M. F." is applied. It is not obvious why it should be looked for in the arc at all. An elastic action implies a return from a more to a less strained condition, and if the energy in the arc is employed in the disruption and mutual bombardment of the carbons, no reversible effect is to be expected.

Professor Fleming suggests that the current may generate heat in direct proportion to its amount when passing from a hot point to a cooler one in carbon vapor, by analogy with the Thomson effect in copper, or solid carbon; the existence of a difference of temperature in the carbon vapor being inferred from the difference of temperature in the carbon rods at the arc. The explanation requires carbon vapor and solid carbon to be in contact at two very different temperatures at the same pressure, and to have very different thermo-electric gradients; since if the gradients were the same, the total development of heat, by a Thomson effect, between the distant ends of the carbons, which are at the same temperature, would be zero. The latter condition may be satisfied; we have no knowledge of the matter; but it is hard to see how two very different temperatures can be found in a small body of vapor, presumably saturated. The existence in hot gases of an effect similar to the Thomson effect in solid conductors is only guessed at, but it offers an interesting subject for experiment. If this effect is found in carbon vapor, E. M. F. between the solid and gaseous carbon might exist at the contact surfaces, similar to the Peltier effect in metals, and the energy converted at those points might be expected, by analogy, to be considerably greater than that due to a difference in the thermo-electric gradients in the solid carbon and in its vapor.

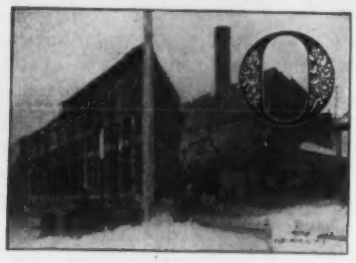
It may be observed here that the reduction in the potential difference of the carbons for a given current, by heating the negative carbon, is explained by the bombardment hypothesis, as well as by Professor Fleming's.

Observations on the distribution of potential in the arc are difficult to interpret, but it appears that the difference of potential between the central part of the arc and the negative carbon is small or zero, and that the whole fall of potential in the arc takes place at or near the positive crater. At this point disruption of matter is taking place, and the generation of heat under these conditions and the generation of heat by a Peltier or Thomson effect, where no change occurs in the condition of the matter concerned, seem phenomena, *prima facie*, to be placed in very different categories. It would seem that little assistance in this question is to be expected from analogies drawn with the phenomena of electric conduction in solids. The phenomena seem rather allied to those of discharges in rarified gases and movements in electrolytic solutions.

Water Power Plant of the Dolgeville Electric Light and Power Company.

Another water power transmission plant for the supply of a load already developed has been built at the High Falls of the Auskerada River, near Utica, N. Y. The plant was built by the Dolgeville Electric Light and Power Company for the supply of power in Dolgeville and Little Falls. A masonry dam has been built up from solid rock above the falls. The total effective head on the turbines is 72 feet, 20 feet of this being obtained in the draught tubes, so that all machinery is well above the tail race water level at times even of severe floods. A large storage reservoir is divided by the dam, which sets back the water for 2500 feet. From the dam a 10-foot steel flume, supported on masonry piers sunk to the rock level, carries the water 500 feet to the power house. This is a substantial building of stone and brick, provided with concrete floors and steel roof, and so situated that it can be extended to accommodate a plant of 3000 horse-power. The initial installation includes two 36-inch Victor turbines, with a capacity of 750 horse-power each. These are coupled to two Westinghouse 450-kw alternating generators, giving a frequency of 7200 alternations per minute at 2400 volts. A rotary converter in the power house gives 500 volts D. C. for use on motors installed hitherto, the lighting load being carried on step-down stationary transformers. Step-up transformers give 10,000 volts for transmission to the city of Little Falls, 8 miles distant, the voltage being there stepped down again to 2200 volts for local distribution. The generators are excited by one exciter, with independent water wheel. Six hundred horse-power will be sold at once to the various manufacturing interests of the village. The company will market the power at the price of approximately $25 per horse-power per year at Dolgeville and Little Falls. It is said that the available water powers in and around the village could readily develop 20,000 horse-power, there being available an aggregate fall of 412 feet in the Auskerada River at seven points within five miles of Dolgeville.

Destruction of an Electric Lighting Substation in Montreal.



ON Sunday evening, February 6, the sub-station at Côte Ste. Paul, Montreal, belonging to the Lachine Rapids Hydraulic & Land Company was destroyed by fire, the origin of which has not yet been determined. The fire broke out at a point near the switchboard, and in a few minutes spread throughout the building, causing its entire destruction. The loss is estimated at not less than $100,000.

This sub-station contained three pairs of stationary transformers of the oil-insulated and water-cooled variety, each of 300-kw capacity. They were used to reduce the three-phase line current from 4500 to 2000 volts, two-phase, for distribution to lighting and power circuits in the vicinity. There were also installed in the same station several synchronous motors driving, by means of a countershaft, several arc dynamos. There was also an equipment of steam machinery which had been used to drive the dynamos of the station previous to the completion of the Lachine Rapids plant.

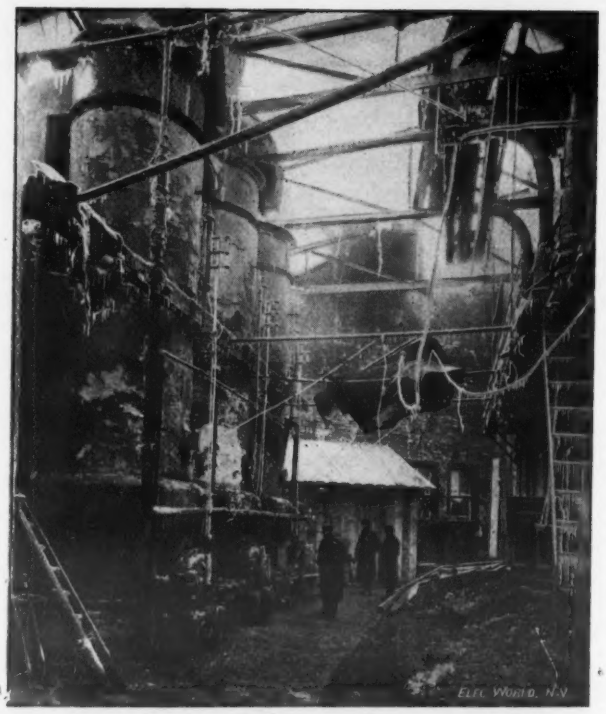
General View of Machine Room.

The destruction of the plant at an early hour on Sunday evening was accompanied with considerable inconvenience to the citizens of Montreal. Several churches were left in darkness, and many families had to go to bed for lack of light.

By exceedingly rapid work the incandescent service was re-established promptly, there being on hand a number of transformers sufficient to replace those destroyed.

The apparatus contained in the building consisted of arc and alternating incandescent dynamos, all belted to the line shaft, shown in the ruins. The machines were as follows: One 60-light Wood, one 50-light and one 35-light T.-H. arc dynamos; one 2000-light T.-H. and two 1000-light Westinghouse alternators, and one 750-light Edison low-voltage machine, besides machines used for exciters. A new equipment had been ordered ninety days previous to the fire to replace this miscellaneous machinery with synchronous motors direct-coupled to large multicircuit arc dynamos, to be fitted with up-to-date marble switchboards, etc. This apparatus has not arrived, but will be hurried now and put in place as soon as possible. The station will be rebuilt as a fireproof structure for its installation. For temporary work some arc machines are being placed at the power house at Lachine Rapids.

Of the emergency work undertaken to re-start the service. Mr. B. S. Kelsch, the general superintendent of the system, writes as follows: "When we arrived at the station, twenty minutes after the fire started, it was a roaring furnace. In the south end of the boiler room there were three pairs of 300-kw Wagner transformers, used for stepping down from 4500 volts three phase to 2000 volts two phase. Seeing that the station and its contents were lost, we made every effort to save these transformers, and requested the fire department to keep three of the four streams of water on the place where we knew that the transformers ought to be. As soon as possible we started to remove from over the transformers a part of the roof that threatened to fall and destroy them and the rubbish that had fallen upon them. As soon as this was done a temporary switchboard was constructed, the transformers were re-wired and a roof was hastily built over the apparatus. By means of hand axes, gasoline blow lamps and hot water the ice was removed from the transformers. Having no fuses, we connected the 2000-volt terminals direct to the bus bars, and when all was ready, ordered the generator at Lachine Rapids started and built up slowly. In a few minutes our pilot lamp grew red and we knew that our incandescent system was again in service, twenty-four hours after the fire started. We were also able to start our arc lamps on time on Monday night through the kindness of the Royal Electric Company, our circuits being split up and connected to their machines used for lighting the city of Montreal. The heat was so intense that it melted the vulcanized bushings from the transformers and expanded the oil inside in spite of the water-jacketing, until it came out through the openings. In spite of this the transformers are apparently uninjured internally."



Boiler Room Showing Temporary Transformer Housing.

A Method of Measuring Self-Induction.

BY EDWIN F. NORTHRUP.

The following method of measuring coefficients of self-induction in terms of a capacity and resistances has only been worked out by the writer on paper. The method is, however, given here in the hope that its simplicity and theoretical accuracy may induce some one to test its actual practicability.

In the diagram r_1 r_2 r_3 r_4 are resistances which are practically free from self-inductance and capacity. They should be made as follows: Take a thin card of micanite or fibre, about 2 feet long and 8 inches wide. Starting at one end wind the resistance wire singly upon the card. The resistance card so wound is practically free from inductance because the turns on opposite sides of the thin card lie close together, and is likewise free from capacity because the ends of the wire, which have the greatest difference of potential, are far apart. The proof of the value and the practical application of this method of winding resistances is due to Prof. Henry A. Rowland.

C is a mica condenser, carefully standardized. B is a battery or source of direct E. M. F. for charging the condenser. K is any kind of device by which the condenser may be rapidly charged by B, and discharged through the resistances and the inductances L_1 and L_2. It is shown in several text books how to fit up a tuning

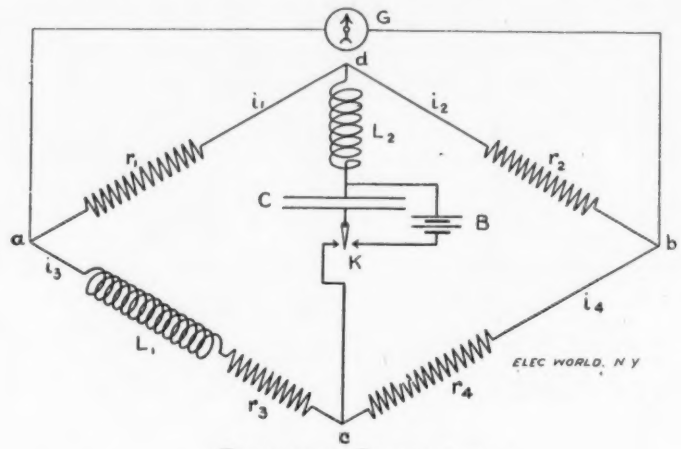


DIAGRAM OF CONNECTIONS.

fork to secure this purpose. G is an oscillating current galvanometer, described in THE ELECTRICAL WORLD December 18 and 25, 1897.

To make the measurement keep K vibrating and adjust the resistance r_1 until G shows no deflection. Then interchange the inductances L_1 and L_2, keeping the total resistance, r_2, between a and c always the same. Again vary r_1, until when its value is r_1' there is no deflection. It is desirable that $r_2 = r_4$ and necessary that $r_2 + r_4$ be small enough so that the discharge of C is oscillatory.

The theory of the method is as follows:

When no current flows through G

$$r_1 i_1 = r_2 i_2 \quad \ldots\ldots(1)$$

$$z_3 i_3 = r_4 i_4 \quad \ldots\ldots(2)$$

where i_1 i_2 i_3 i_4 are currents in the different branches and z_3 is the impedance between a and c.

Multiplying together (1) and (2)

$$z_3 r_2 i_2 i_3 = r_1 r_4 i_1 i_4 \quad \ldots\ldots(3)$$

$i_1 = i_3$, $i_2 = i_4$, therefore $i_1 i_4 = i_2 i_3$ and from (3)

$$z_3 = \frac{r_1 r_4}{r_2} \quad \ldots\ldots(4)$$

$$z_3^2 = r_3^2 + L_1^2 \omega^2 \quad \text{hence,}$$

$$L_1^2 = \frac{r_1^2 r_4^2 - r_3^2 r_2^2}{\omega^2 r_2^2} \quad \ldots\ldots(5)$$

Since the discharge from C is oscillatory, the period, T, is

$$T = 2\pi \sqrt{L_2 C}. \qquad \omega = \frac{2\pi}{T} = \frac{1}{\sqrt{L_2 C}}.$$

Substituting the value of ω^2 in (5)

$$L_1^2 = \frac{r_1^2 r_4^2 - r_3^2 r_2^2}{r_2^2} L_2 C \quad \ldots\ldots(6)$$

Now interchange L_1 and L_2 and again obtain a balance by varying r_1 until its value becomes r'_1, then

$$L_2^2 = \frac{r'^2_1 r_4^2 - r_3^2 r_2^2}{r_2^2} L_1 C \quad \ldots\ldots(7)$$

Substitute this value of L_2 in (6) and we obtain

$$L_1^2 = \frac{(r_1^2 r_4^2 - r_3^2 r_2^2)^2}{r_2^4} C^2 \frac{r'^2_1 r_4^2 - r_3^2 r_2^2}{r_2^2} \quad \ldots\ldots(8)$$

In practice r_3 would be made equal to r_4 when (8) becomes

$$L_1 = C (r_1^2 - r_2^2)^{\frac{3}{2}} (r'^2_1 - r_2^2)^{\frac{1}{2}} \quad \ldots\ldots(9)$$

Conversely if L_1 is known C can be determined.

Other methods upon the same general principle may be worked out.

Regulation of the Humidity at the Boston Telephone Exchange.

The Bell Telephone Company, of Boston, has been experimenting in various ways to find a means of obtaining an environment of the best sanitary conditions for its exchange operators. The work of the central station operator is necessarily confining, exacting and a constant trial to the nerves. An improvement of the comfort of the operators is bound to effect a corresponding improvement in the service which they may give. In the Boston experiments the methods of the Weather Bureau were adopted, and the observations subjected to careful study. The most desirable percentage of humidity, a simple method for measuring and facilities for adjusting the same were found and apparatus installed for making at all times a correction in the percentage of moisture such as to bring it to the proper amount.

The most extensive investigations which have been made on the relation of humidity to health are those of the Michigan State Board of Health. Their observations extended over seven years, and included a detailed study of the prevalence of disease, week by week, together with a complete series of weather observations. The facts were thoroughly correlated in several ways, and from them the telephone officers decided to adopt a standard of 50 per cent. of saturation. The air in the building is drawn down a flue and heated by a large steam heater before being distributed through the rooms. Added humidity is given to it by a jet of steam, 2½ grains of water being added to each cubic foot of air in cold, dry weather, aggregating for this building over a gallon a minute. It is said that this gives the air a peculiarly fresh feeling, like that of the atmosphere on a bright spring morning, and markedly different from the dry, close effect of the average indoor atmosphere in winter. A wet and dry bulb hydrometer is used to determine the percentage of humidity.

Tests of Porcelain Insulators.

The following admirable advice on the testing of insulators for high tension circuits is given by Prof. F. A. C. Perrine in an article in *Electrical Engineering*. "In applying electrical tests it seems foolish to attempt only tests upon the finished glazed articles, since, if the glaze is perfect, it will completely mask the most serious extent of porosity, and even twice the potential of the line may not pierce a defective insulator, which will fail during the first rainstorm after the glaze has been worn away by the wire. The proper time, therefore, to apply any electrical test to the porcelain insulator is while the insulator is in the biscuit and before it has been glazed. It is always perfectly easy to test for porosity and to stamp the accepted insulators under the glaze by a mark which cannot be counterfeited after glazing has been performed. Even a galvanometer test at moderate potentials in this stage will furnish more accurate knowledge of the state of the porcelain than a high potential test after the glazing has been applied. Especially is inspection at this time important, as the glaze will mask cracks as well as porosity, which cracks would be apparent to the eye of the inspector before glazing, although completely covered by skillful work in the glazing process."

American Machinery in the Argentine Republic.

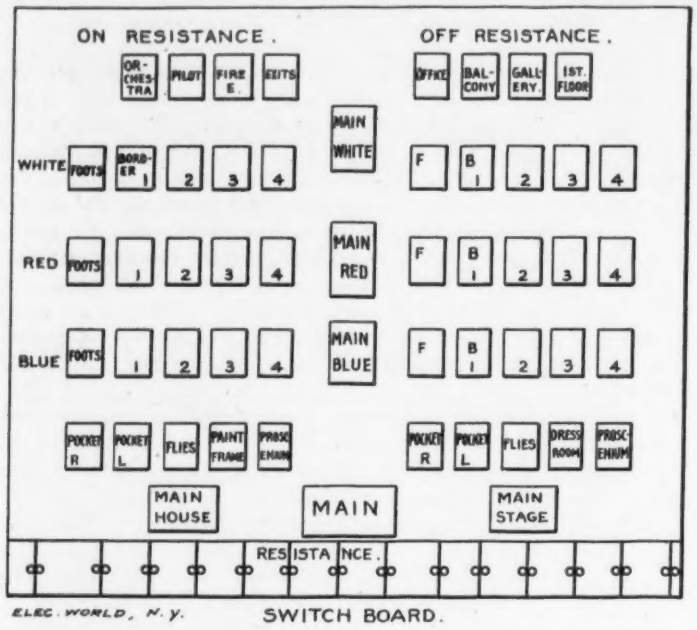
A list of the names of the makers of the apparatus used by the electric street railway line in Buenos Ayres will be interesting to North American readers. The station was built by the Berlin Iron Bridge Company, and is fitted with Stirling boilers, Ball & Wood engines, Walker generators, Green economizers and Worthington pumps. The line is equipped with Brill cars, General Electric motors and Edison-Brown bonds.

The Switchboard for Stage Lighting.

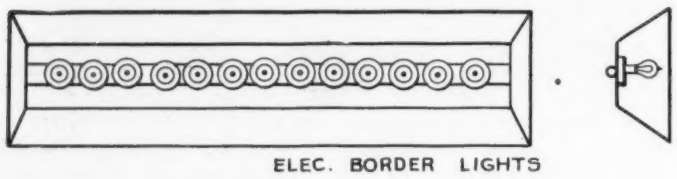
BY H. BISSING.

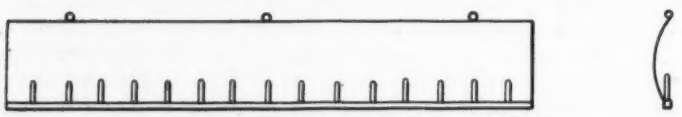
Since the lighting of a theatre has become one of the principal points of consideration in its construction many switchboards for this purpose have been designed, but it has been the invariable rule that the best board was installed by the engineer with stage experience.

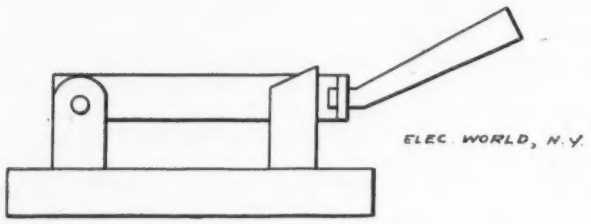
There is nothing essentially intricate about the average stage board; in fact one should always aim at simplicity in its design;



nevertheless it is absolutely necessary to consider the rapidity with which changes must be made without too great a discomfort to the operator. The problem of the arrangement of switches is somewhat similar to that of the arrangement of the keys on the typewriter. For instance, all the stage lights are turned on white, and it is necessary to "go dark" and come up after the change of scene to

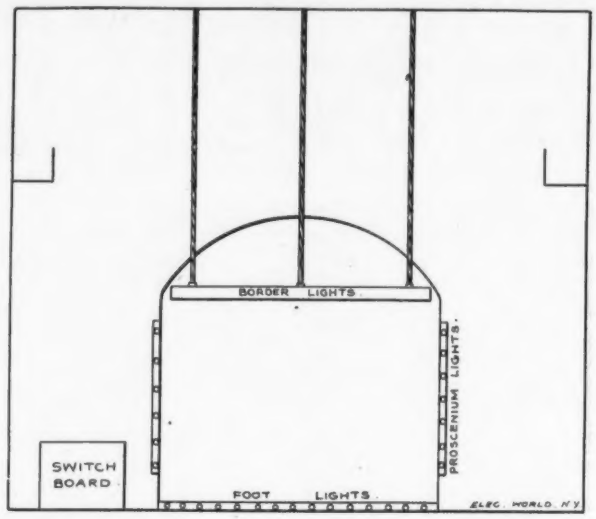


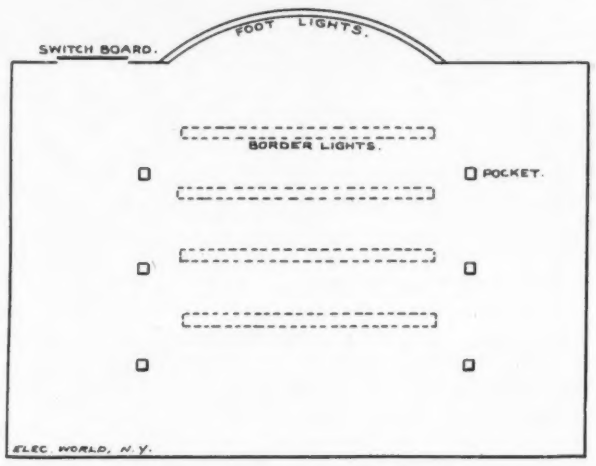




red in front full up, blue in back half up; a change which is quite common. To do this with some of the switchboards installed it would be necessary to operate not less than ten switches, while with other boards, no more expensive or elaborate, the same change could be obtained with three movements. Of course the problem of design is different in each installation; the size of the theatre, the number of lamps, the space, and last and most important, the amount of money to be expended are important factors to be considered.

In a theatre which is known as a week stand house there should be on the stage three colors in the footlights, five border lights with three colors each, and at least three pockets on either side, each capable of carrying ten incandescent lamps; in addition to this are the lights in the auditorium, lobbies, offices, etc. Assuming such a theatre to have a proscenium opening of 40 feet, with footlights 30 feet, and border lights 40 feet long, there should be about sixty white lights, thirty red and thirty green or blue lights in the foots, and thirty of each color in each of the border lights. The footlights are usually stronger than the border lights, since it is intended that the glare of the former on short range shall light up the features of the actors; while the border lights diffuse an illumination which tends to brighten up the entire stage. Each color should be controlled by a separate switch for the footlights and for each border light. It is also necessary that each color should be capable of being controlled by





Plan and Elevation of Stage.

one switch and each color in the footlights, and each border should be capable of being thrown on resistance separately or all together.

As regards the location of the switchboard, it is always best to have it placed in a recess, if possible, near the curtain line. In theatres playing attractions for short periods it should be on the stage level, but in metropolitan houses, where each company stays several months, it is advantageous as regards economy of space to have it elevated 5 or 6 feet higher. It has often occurred to the writer that the right side of the stage is the best for the board, since the operator always works with his right hand, and therefore can easily look over his left shoulder, whereas if he were on the left side of the stage he would be compelled to look over his uplifted right arm. In addition to the switches for the various colors there should be one switch for the entire house and stage, one each for the house and stage and one for each color altogether. Orchestra and pilot lamps should, of course, be independent of any main switch and at the same time should be capable of being thrown on resistance, since in these days of large spectacular effects the orchestra lights throw out enough light to spoil an effect.

In the arrangement of the switches on the board individual taste and experience is the best guide. It is preferable, of course, to have

the board as symmetrical as possible. The illustration will give an idea of a good switchboard for the week-stand house mentioned above. Of course no attempt has been made to go into detail. The board, as shown, is divided in two parts; one side for resistance circuits, the other for non-resistance. It has been the excellent practice of a few makers to arrange a device on the board by which all the switches controlling the same color can be thrown into engagement with a single lever, and thus be operated simultaneously.

The switches best suited for a theatrical board are the ordinary knife switches; and for the smaller circuits what is known as the "baby" knife switches. To facilitate operation it is best to have the handles of these switches at an angle with the switch blades instead of lying in the same plane, as shown in the illustation.

Now that much depends on the lighting of a piece it has become customary for managers to carry a supply of arc lamps with them from town to town; and therefore in installing a switchboard it is best to calculate the lead wires for a load of from 150 to 200 per cent. over what is regularly used in the theatre.

Removing Rust from Iron Electrically.

A very simple and effective way of cleaning rusted iron articles, no matter how badly they are rusted, consists, according to Carl Hering, in attaching a piece of ordinary zinc to the articles and then letting them lie in water to which a little sulphuric acid is added. They should be left immersed for several days, or a week, until the rust has entirely disappeared, the time depending on how deeply they were rusted. If there is much rust a little sulphuric acid should be added occasionally. The essential part of the process is that the zinc must be in good electrical contact with the iron; a good way is to twist an iron wire tightly around the object and connect this with the zinc, for which a remnant of a battery zinc is suitable, as it has a binding post. Besides the simplicity of this process, it has the great advantage that the iron itself is not attacked in the least as long as the zinc is in good electrical contact with it. When there is only a little rust a galvanized iron wire wrapped around the object will take the place of the zinc, provided the acid is not too strong. The articles will come out a dark gray or black color and should then be washed thoroughly and oiled. The method is specially applicable to objects with sharp corners or edges, or to files and other articles on which buffing wheels ought not to be used. The rusted iron and the zinc make a short circuited battery, the action of which reduces the rust back to iron, this action continuing as long as any rust is left.

A Professional Opinion.

The Fourth Estate, which is a newspaper for newspaper men, and one of the brightest of that ilk, has this to say of the New Year's issue of THE ELECTRICAL WORLD:

"*The Fourth Estate* has so often found reason to commend the special issues of various trade journals that it might seem that the ground of approval had been quite well covered. New merits certainly warrant fresh praise, however, and it cannot be amiss or trite to speak approvingly of such an issue as that of THE ELECTRICAL WORLD for January 1. This paper is a magnificent commercial tribute to electricity as a modern industrial power, and publishers who wish to see how artistic and adequate in all respects an advertisement can be made should send for a copy for the sake of the two-page advertisement on pages 98 and 99. This is an advertisement of Dixie Belt Leather, which is manufactured by Charles A. Schieren & Co., of which firm ex-Mayor Schieren, of Brooklyn, is the head."

Recording Machines in Place of Telephones.

Two new printing telegraphs, developed in Europe and known respectively as the telescriptor and the zerograph, are being actively exploited in London for use on circuits organized like telephone exchange systems. This will be recognized as very similar to the attempt now being made in this country to introduce the telautograph into such service. A further advantage in this work is claimed for one of these machines in that it is a synchronous device, and two subscribers can adjust the periodicity of their instruments and thereby render the message indistinguishable to any one attempting to cut in on the line.

The Difficulties of Water Wheel Governing.

Some of the peculiar difficulties of the speed governing of water wheels, as compared with that of steam engines, are well pointed out in a paper recently read by Mr. Mark A. Replogle before the Franklin Institute, and are abstracted below.

If a wheel supplied with power through a long closed pipe containing hundreds of tons of water, running at normal speed, has a part of its load removed, the speed immediately begins to rise. If, under these conditions, the gates are promptly closed in part to reduce the supply of water, the inertia of the long column in the closed pipe will increase the pressure at the orifice and cause practically the same amount of water to enter the wheel at a higher velocity. This flow of water at a higher velocity gives an increased torque to the wheel for the instant, and thereby tends to still further increase the speed above that caused by the reduction of the load. The action is similar in case of increased load and increased gate opening. The long column of water has necessarily to be accelerated, and until the force of gravity has time to effect this acceleration, the head at the wheel is reduced, thereby diminishing the torque temporarily with increasing load. These unfortunate effects make the governing of water wheels a more difficult problem than that of steam engines.

Another difficulty is the heavy and unwieldy character of the water wheel gates and their generally unbalanced condition, whereby the pressure upon them causes great frictional resistance to their movement. Turbine wheel gates, built in this country, often weigh several thousand pounds each, and sometimes must be moved several feet through water in being opened. Often it is necessary to add weight equal to their own weight as a counter balance. The power required to overcome the inertia of and move this mass often reaches many thousands of foot pounds. It can be readily seen that to govern such gates with precision requires machinery both delicate and powerful. In case of wheels driving electric generators, the load of which can be instantly varied between the widest limits, it is plain that successful governing is considerable of a problem.

The effect of inertia, combined with the incompressibility of water, is shown by an experience at the power transmission plant at Fresno, Cal. There a closed pipe line, 3800 feet long, runs from the forebay to the power house, the head at the latter point being 1400 feet. For some distance from the forebay the pipe is virtually horizontal, the head is slight and the construction is correspondingly light. The gradient then increases, running down steeply to a point near the power house. Through some error, at the time when the plant was about ready for operation, a valve at the power house was opened, allowing a 4-inch stream of water to escape. The pressure gauge dropped from the normal indication of 610 pounds to the square inch to 350. The valve was promptly closed by the attendant when the pressure gauge immediately ran up to its limit, 1000 pounds to the square inch, followed by a great writhing in the pipe, which promptly burst at a point about midway of its length. Further investigation showed that the upper part of the pipe had collapsed, This is explained by the fact that, on the water being freely released by the rupture of the line, the liquid in the steep portion of the pipe had fallen by gravity and drawn quite a considerable vacuum in the upper, more nearly horizontal part, in attempting to accelerate the heavy water lying therein.

Wherever it is desirable, for the sake of economy, to avoid the use of by-pass valves or deflecting nozzles, or any other such devices in which the flow of water is constant, regardless of the load on the wheels, the governors should be so designed that they will not vary the orifice so fast that the head will be seriously altered owing to the momentum of the moving column. To obtain proper regulation with such governors, heavy flywheel capacity must be added to the moving parts. To avoid hunting of the governors they are generally made on the differential relay principle whereby the speed falls slightly with increase of load as does that of the ordinary steam engine. Sometimes the governor is slightly modified by the addition of what is called the returning feature, whereby the speed is gradually restored under any load to the normal no-load rate, the speed being allowed to drop momentarily with increase of load and rise momentarily with diminished load, but being gradually restored by the returning action of the governor to normal. With either arrangement the flywheel effect should be sufficient to prevent the wheel from varying with any ordinary change of load by an amount greater than that comprehended by the full range of governor-ball movement. This will prevent hunting and insure smooth governing.

The Evolution of the Rail Bond.

To the Editor of the Electrical World:

Sir:—In a discussion of the plastic rail bond in your issue of February 5, page 193, Professor Fessenden makes a statement which I ought not to let go unchallenged. He says: "Up to this time no method had been known of amalgamating iron in the cold, the amalgam having previously been prepared by electrolysis or from iron solutions, but never having been amalgamated directly." The facts are that I used to show and teach to my classes in chemistry in the High School of Philadelphia over twenty-five years ago the simple truth that although iron or steel would not amalgamate with mercury ordinarily, they would do so if there was some sodium in the mercury. This must have been known to many others besides myself, and my students were shown the effect. My penknife blades of that period were often wet with mercury applied in the way referred to. I have frequently used the method since that time.

Elihu Thomson.

Lynn, Mass., February 5, 1898.

To the Editor of The Electrical World:

Sir:—I have to thank Professor Thomson for correcting me in the matter referred to. The fact that even such a standard work as "Watt's Dictionary," though devoting a half-page, Vol. III., p. 888, to iron amalgams, and describing three ways of making them does not mention this method, is, I believe, a sufficient excuse for my mistake. I was led myself to use the material through being at the time engaged in using it as recommended by Crookes, for working gold ores containing sulphur. As I remember it, no results were got by applying it to the iron before treating with the solution mentioned, but in the light of Professor Thomson's letter, this was probably due to the fact that the surface of the rails was never very clean.

Allegheny, Pa. Reginald A. Fessenden.

To the Editor of the Electrical World:

Sir:—I have sent a copy of Professor Fessenden's letter in your issue of February 5 to Mr. Edison for his comments, his answer being as follows: "Professor Fessenden is mistaken. Sodium amalgam has been used for years at my laboratory and such joints were made on the first railroad at Menlo Park in 1881. Edison."

This style of bond was incorporated in one of Mr. Edison's early electric railway patents. The difficulties in handling this material led to very decided changes and improvements in which that amalgam was replaced by others.

I notice also a letter in the same issue by Mr. S. H. Harrington concerning the alleged high cost and transitory nature of plastic bonds. I have several letters from railway men under whose direction from sixty to ninety joints per day have been made by one mechanic at $2.50 and three laborers. I should like to make the following proposition to Mr. Harrington: Let us each choose a road on which our respective bonds have been in use for three years or even for two years. Let 1000 bonds on each of these roads be tested by using a motor generator, to put through each bond a current equal to the full capacity of the rail at an equivalent of 1000 amperes per square inch of copper. The person whose bonds make the poorer showing shall then pay all the expenses of the tests and sign a certificate setting forth the facts in the case. Harold P. Brown.

New York City.

The Boston Meeting of the American Street Railway Association.

As previously noted in these columns the American Street Railway Association will hold its seventeenth annual meeting at Mechanics' Hall, Boston, Mass., September 6, 7 8 and 9 1898. The headquarters of the association will be at the Hotel Brunswick, the Hotel Vendome, which is under the same management, being also used in connection with the Brunswick.

Papers will be read on the following subjects: "Maintenance and Equipment of Electric Cars for Street Railways," "To What Extent Should Street Railway Companies Engage in the Amusement Business?" "Underground Electric Roads—Construction and Management," "Carrying of United States Mail on Street Railways," "Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use," "How to Care for Return Current," "Inspection and Testing of Motors and Car Equipment by Street Railway Companies."

The Relations Between the Customer, the Consulting Engineer and the Electrical Manufacturer.

To the Editor of the Electrical World:

Sir:—I have been interested in the discussion as to consulting engineers as an intervening medium between customer and manufacturer and in Mr. George White-Fraser's comments on Mr. S. Dana Greene's recent article.

Perhaps Mr. Greene has had some such experience as others in the electrical manufacturing business, where electrical engineers, so-called, have been selected as consulting engineers, whose acquaintance with the practical side of the business has not been sufficient to render them useful. For instance, these two experiences have occurred under my notice:

First, An engineer (and a very excellent engineer too; in fact, one of the best in the country), in 1891 or 1892 expressed the opinion that armature spiders should be bored to fit engine shafts, and that the engine shaft should not be constructed to fit the bore of the armature spider; which practically amounts to saying that the engine builder and not the dynamo builder should determine the size of shaft necessary to transmit the power. As you well know, there has been standardized by all reputable electrical manufacturers a practice the opposite of the one preferred by this engineer; nevertheless, where (in 1897) this standard practice was followed, the consulting engineer required new armature spiders, so as to conform to the engine shaft which had been made too small for the bore, and which, in the opinion of the dynamo builders, was too small for the work with a proper margin for safety.

Second, Another electrical engineer, so called, occupying a responsible and prominent position, actually made the following test: A motorman was sent out with a flag on an electric road, the distance being some measured one of about 1000 or 1500 feet, with instructions to drop the flag whenever an indicating device moved; and this engineer stood at the feeder switch, where he could complete the circuit and take on a stop watch the time of the motorman's dropping his red flag; the avowed purpose of this test being to determine how long it took for the current to go from the feeder switch to the indicating device!

Can you wonder that, if Mr. Greene has fallen in with such instances as these, he, representing as he does a large concern, anxious and willing to do the best work and to pay good prices to the best engineers it can find, and to train these engineers after it finds them, should be somewhat impatient of the intermediation of alleged consulting engineers?

I do not write in criticism of competent men, but the difficulty is that the manufacturer has no say in the selection of the consulting engineer, and the customer, in nine cases out of ten, is totally incompetent to make such a selection—as much so as the average layman is incompetent to select a specialist among physicians. In most cases, chance or prejudice will dictate the choice.

Schenectady, N. Y. T. J. Johnston.

The Motor Suspension Decision.

Concerning the recent opinion handed down by Judge Wheeler in the case of the Sprague Electric Railway and Motor Company *vs.* the Union Railway Company, Mr. Rudolph M. Hunter, who is well known in the electrical patent field, writes The Electrical World as follows:

"The Sprague patent is of fairly early date, and the features involved are generically different from the prior art, as well as specifically in the direction pointed out in the opinion. The construction by which the motor is hinged to the main axle and the armature rigidly supported from the motor frame, whereby the armature shaft is always maintained parallel with and at the same distance from the main axle; and further, in which the free end of the motor is flexibly suspended, is novel, useful and distinguishable from the prior art. It is peculiar to the art of electric propulsion and differs radically from the Adams' patent of 1883, and is "independent" of it, as Judge Wheeler says. The idea that the court intended to confine the patent to the construction in which the armature bearings are directly bolted to the pole pieces is improbable. A patentee is entitled to common sense equivalents, and the modifications in the design of the motor since the date of the Sprague patent should warrant some liberality. In any event, the bearings are rigidly connected to the pole pieces, even if the connection is indirect and through the yoke. In a motor not concentric with the main axle, the proper concentric relation of armature and pole pieces and hinged relation of motor and main axle are the points required and attained in either case."

Digest of Current Electrical Literature

American and Foreign.

by Carl Hering.

Dynamos, Motors and Transformers.

SELF-STARTING POLYPHASE MOTORS. Boucherot. "L'Ind. Elec.," Jan. 25 and "L'Eclairage Elec.," Jan. 22.—An abstract of a paper read before the International Society. The curve representing the torque of a polyphase motor as a function of the speed has very different forms, depending largely on the resistance of the armature; if this is low there will be a very small starting torque; the couple increases with the speed up to a maximum, and becomes zero at synchronism; if the armature resistance is sufficiently great, a couple can be obtained varying inversely with the speed, but the disadvantage is that there will be great slippage at the normal speed; by placing two windings on the armature, one of small and the other of great resistance, a curve has been obtained which is equal to the sum in the two preceding cases, and which decreases as the speed increases, while the slippage at normal speed is small. There are two series of concentric holes in the armature, the external ones containing the wires of high resistance and the interior ones the other; at starting, the former is used alone, while for normal load the interior is the only one in use; the only disadvantage is that the cosine of the angle of lag is low, being about 0.7, but he claims that this is not of as great importance as is usually supposed. A second type of motor has two inducing fields, one of which is shifted in phase with regard to the other; they are connected at their extremities by a low resistance, and in their middle by a higher one; if they are not out of phase the E. M. Fs. have opposite signs in the two halves of a bar, and the circuits are closed by the interior high resistance connection for starting. A series of motors thus connected has a starting torque of 2.4 times the normal, with a current less than 2.4 times the normal.

ELECTRIC GENERATORS. Parshall and Hobart. Lond. "Engineering," Jan. 21 and 28.—A continuation of their long serial. They continue the discussion of the magnetic materials; it is of a very practical nature, and is accompanied by a large number of curves. The materials are discussed under the respective headings; among other things they say that cast iron, other things being equal, is more costly than cast steel for giving magnetic results; in malleable cast iron there is a marked increase in the permeability; cast steel for magnetic purposes is generally made by the open-hearth process, and is the material most generally used; Mitis iron is a little better than ordinary steel up to 100 kilo-lines, but at high densities it is somewhat inferior; up to that density it is practically identical with wrought-iron forgings; curves are given; some of the nickel-steel alloys possess remarkable magnetic properties, which are shown by curves. The energy losses in sheet iron are also discussed, and values for the hysteresis loss and an equation for calculating the eddy current losses are given.

DYNAMO DESIGN.—Lond. "Elec. Rev.," Jan. 28.—A discussion and unfavorable criticism of the recent article by Zingler to which the latter replies.

SHIELDED CONDUCTORS. Still. Lond. "Elec. Rev.," Jan. 28.—A criticism of the recent article of Price, in which he claims that that writer missed the point in regard to eddy currents.

SHIELDED CONDUCTORS. Price. "El'ty," Feb. 9.—A reprint of the article abstracted in the "Digest," Feb. 5 and 12.

Lights and Lighting.

INCANDESCENT LAMP HOLDER.—Lond. "Elec.," Jan. 28.—A note calling attention to the expiring on that day of the important British patent of Dornfeld, which covers the use of spring plungers, and describes the bayonet holder. As that holder is used more in England than in other countries, the patent is chiefly of local interest.

RENEWABLE INCANDESCENT LAMP.—Lond. "Elec. Rev.," Jan. 28.—An illustration, with a brief description, of the Howard lamp, which was mentioned in the "Digest," Jan. 15 and 22, and is constructed so that the filament may be easily renewed.

MUNICIPAL LIGHTING.—"Elec. Eng.," Feb. 3.—An editorial abstract of a recent report report by Foster, on some plants in New York City, which is unfavorable to municipal lighting.

COST OF ARC LIGHTING. Keating. "Elec. Eng'ing," Feb. 1.—An extract from his recent report for the city of Toronto.

CITY LIGHTING. Barrett. "Elec. Rev.," Feb. 9.—A reprint of his report as superintendent of street lights of Des Moines.

Power

12,000-VOLT DISTRIBUTION.—"L'Ind. Elec.," Jan. 25.—A note stating that an installation is to be erected at Lancey, the current from which is to be sent to fifty villages radiating to a distance of 40 km.

ELECTRIC ELEVATOR. Herard. "L'Elec.," Jan. 29.—An illustrated description of the Guyenet and de Mocomble elevator, which has a hydraulic brake.

BI-PHASE INSTALLATION. Ritter. "L'Eclairage Elec.," Jan. 15.—An abstract from "Génie Civil," Jan. 1, of a description of a central station at Montier-Grandval, operated by water power and generating bi-phase currents.

BI-PHASE INSTALLATION. Ziegler. "L'Eclairage Elec.," Jan. 22; abstracted from "Génie Civil."—A brief description of an installation in textile works at Mulhouse.

MECHANICAL APPLICATIONS OF ELECTRICITY. Richard. "L'Eclairage Elec.," Jan. 15.—A continuation of his profusely illustrated descriptions, taken from patent specifications; some of these are reproduced in another column.

POWER TRANSMISSION. Perrine. "Elec. Eng'ing," Feb. 1.—A short editorial, stating that all work has ceased on the 33,000-volt plant for transmitting power from Santa Ana River to Los Angeles, as the company is without funds; the feeling among engineers, however, concerning the practicability of using 30,000 to 40,000 volts is continually growing stronger.

Traction.

ELECTRIC TRACTION ON STEAM RAILROADS. E. H. "L'Ind. Elec.," Jan. 25—A short article, discussing the probable future. Experience has shown, beyond doubt, that compound steam locomotives can draw 200 tons at a speed of 115 km. per hour on a level, and therefore the electric locomotive should do as well, or better; for higher speeds and heavier trains the self-propelling locomotive must be abandoned, and its power increased by generating it at a stationary central station, and transmitting it to the locomotive by conductors; the objections to this system are mentioned, and some of them replied to; it is not thought best to replace all steam locomotives by those operated electrically; he seems to favor the use of steam locomotives on the same lines, as is done in this country; he concludes that on lines on which the present speed is to be greatly increased electric power should be used, and only on such lines.

MECHANICAL FEATURES OF ELECTRICAL TRACTION. Dawson. Lond. "Elec.," Jan. 28.—The beginning of a reprint of his long recent paper read before the Institution of Mechanical Engineers, and noticed before in these columns.

ELECTRIC RAILWAYS IN GERMANY.—Lond. "Elec. Rev.," Jan. 28.—An abstract, with a table, of the article noticed in the "Digest," Jan. 29.

HEILMANN LOCOMOTIVE. Waskowsky. "Elek. Zeit.," Jan. 27.—A well-illustrated description of the new form of this locomotive.

POSSIBILITIES AND LIMITATIONS OF ELECTRIC TRACTION. Sprague. "Eng. Mag.," Feb.—The second portion of his article (see "Digest," Jan. 15). He discusses the extension of his multiple unit system to the main lines. He concludes that motors, or motor combinations, can be built which surpass in power, traction and speed any locomotive which it is practical to construct and to operate; all necessary power can be efficiently transmitted for reasonable distances; frequency of service ordinarily determines the adoption of the electrical system; all street, elevated, underground and surburban railroads, beside many branch and some special lines, should now be operated electrically; his multiple unit system is claimed to be the preferable one to use for trains; he recommends storage batteries as auxiliaries; every road must be considered by itself.

POWER CONSUMPTION ON ELECTRIC RAILROADS. Dodd. "Elec. Rev.," Feb. 9.—A brief abstract of a paper read at the Civil Engineers' Club of Cleveland. He discusses the resistance of moving cars, and reviews the ordinary formulas, comparing them with some recent data, concluding that the old formulas gave results rather high at low velocities, but too small resistances at high velocities; acceleration is also discussed, and the power consumed; on several interurban roads he found that 400 pounds per ton was the maximum horizontal effort to be expected from the electric motor. The abstract contains no further data.

EFFICIENCY TEST OF STORAGE BATTERY ROAD.—"West. Elec.," Feb. 5—A reprint in detail, with curves and data, of the tests of the road from Chicago to Englewood, an illustrated description of which, with an abstract of the text, was published in THE ELECTRICAL WORLD, Feb. 5.

ELECTRIC ICEBOAT.—"El'ty." Feb. 9.—A brief description of one which was recently tried in Washington on a very small scale; although the motor was only of one-tenth horse-power, it drew a load of 940 pounds against a strong breeze.

Installations, Systems and Appliances.

ISOLATED PLANTS VS. CENTRAL STATIONS. Lond.

"Elec. Rev.," Jan. 28.—A short editorial article pointing out that isolated plants will be superseded only when the price for current from central stations is reduced; the use of accumulators charged during the daylight hours is recommended; large consumers are justified at present prices to generate their own supply.

METHODS OF CHARGING. Claude. "L'Eclairage Elec.," Jan. 15.—A long article analyzing the system proposed by Brown and Routin, and which is considered a very important contribution to the question of the rational methods of charging.

MAXIMUM DEMAND INDICATOR.—Lond. "Elec. Eng.," Jan. 28.—Brief answers to a question calling for a description of the Wright indicator, and the purposes for which it is used; a diagrammatic illustration is given.

INDIVIDUAL OR SUB-STATION TRANSFORMERS.—Lond. "Elec. Eng.," Jan. 28.—A number of answers to the question what the relative advantages and disadvantages of these two systems are.

CENTRAL STATIONS FOR FRANCE.—"L'Ind. Elec.," Jan. 25.—The eighth annual edition of the statistics published by that journal, in a fifteen-page supplement. The number of stations has increased very slowly, there being only fourteen additional ones this year.

SWITCH FOR INDUCTIVE RESISTANCES. Mueller. "Elek. Zeit.," Jan. 27.—An illustrated description of his switch, which was described some years ago, but has been greatly improved since, and is used in large numbers. The switch contains a main and an auxiliary blade, the first of which is for connecting and disconnecting the inductive resistance, and the latter for connecting and disconnecting the inductionless resistance contained in the switch itself; both are mounted on the same axis; when the small lever leaves its contact the current is sent through the inductive resistance; on disconnecting, the auxiliary inductionless resistance is connected for a moment in parallel to the inductive resistance, after which the other switch breaks the current for the two circuits. It is used where it is necessary to protect the insulation of the coil from the high voltage spark, and also to relieve the switch of the spark.

ELECTRIC VALVES. Pollak. "L'Eclairage Elec.," Jan. 15.—A communication concerning a recent criticism of his rectifiers, that is, the apparatus which will transmit currents in one direction but not in the other. He does not consider his redresser or his condenser as being in an industrial form; an apparatus for 86 phases, 57 volts and 1 ampere per sq. dcm. of the aluminum plate will last from forty to sixty hours, which is not sufficient for practice.

OBJECTIONS TO MUNICIPAL OWNERSHIP. T. C. Smith. "Eng. Mag.," Feb.—An article in which he discusses the question whether a city should erect and operate a gas or electric light plant. He discusses it under the headings of legal rights, moral rights and good policy.

MUNICIPALIZATION.—"Elec. Eng'ing," Feb. 1.—A number of extracts and short articles, including one on the use and abuse of corporations by Gratwick.

Wires, Wiring and Conduits.

STANDARD WIRE GAUGE. Cheesman. Lond. "Elec.," Jan. 28.—A table in the form of a supplement, accompanied by a short article, in which is a recalculation of his table, which is used largely in Great Britain and the Continent. The sizes are those of the Imperial or Board of Trade standard wire gauge. It is based on the newly defined ohm, represented by 106.3 cm of pure mercury of 1 sq. mm. in cross-section; this is 1.36 lower than the other, but easily converted into B. A. units by multiplying by 1.01351. The standard of resistance of pure copper is the one originated by Matthiessen, namely, that the resistance of 1 foot of annealed copper wire weighing one grain at 0° C. is 0.2064 B. A. units.

FEEDING CENTRES. Hetherington. Lond. "Elec. Eng.," Jan. 28.—He points out the requirements for low tension systems, showing the difficulties in the design of such boxes, remarking that none of those described in a recent number of that journal are satisfactory.

LITIGATION CONCERNING HOUSE WIRING. Zingler. Lond. "Elec. Rev.," Jan. 28.—The first part of an article, chiefly of local interest, deploring the way in which the law courts decide technical questions.

WEATHERPROOF WIRE. Dow. "Elec. Eng'ing," Feb. 1.—Perrine, in a recent article, took exception to the universal practice of using weatherproof wire; the present writer does not agree that these cheap coverings should be abandoned; too much should not be expected from them; the covering has a value which warrants its use, and this he endeavors to show; the coverings are sufficient for dry-weather work, and nothing but high-class rubber, like that for underground work, would be safe in wet weather; proper rules should be made and vigorously enforced in connection with the handling of such wires.

Electro-Physics and Magnetism.

RIGHI'S NEW COHERER. Tuna. "Zeit. fuer Elek." Jan. 23.—A short article describing his researches made with the new Righi coherer. Attention has not been called to the fact that a sensitive coherer cannot be brought to a high resistance, except with great difficulty, if it remains in circuit, but that generally a very small shaking will suffice when the current is interrupted; he therefore uses a second relay, by which the coherer current is broken as soon as the Morse key has been moved; he obtained the best results with aluminum filings; when the coherer is in circuit it is a matter of chance whether the shaking will increase or decrease the resistance, and this increases the difficulties in the use of the Branley coherer; in his present arrangement, which is illustrated, the Morse apparatus records only dots, dashes being represented by a succession of dots. He believes the new form of Righi coherer will make it possible to telegraph with certainty within limits where it was formerly possible only under the most favorable conditions.

ELECTROSCOPIC WAVE DETECTOR. Topler. "Wied. Ann.," No. 13; abstracted briefly in the Lond. "Elec.," Jan. 28.—He describes his modified electroscopic arrangement, which may be made very sensitive; the waves in the resonator set in violent motion a fine aluminum wire suspended between two cylinders, and conveying the discharge from one to the other.

DOUBLE REFRACTION OF ELECTRIC WAVES IN WOOD. Mazzotto. "Rend. Acc. Linc.;" abstracted briefly in the "Proc. Lond. Phys. Soc.," Dec.—He investigated eight different kinds of wood, and found that the indices vary between 1.54 and 2.24; the velocity perpedicular to the fibre is greater than when parallel.

PENETRATION OF ELECTRIC WAVES IN A METALLIC VESSEL. Righi. "Rend. Acc. Linc.," 6, p. 59; abstracted briefly in the "Proc. Lond. Phys. Soc.," Dec.—He found that unless completely enclosed the waves appear to pass freely into the interior; the waves do not penetrate through the opening, but there are secondary waves produced in the vessel, which are ineffective when all parts of the vessel communicate with each other.

RELATIVE MOTION OF THE EARTH AND ETHER. Sutherland. "Phil. Mag.," Jan.—He shows that a slight alteration in the point of view of the theory of the experiment of Michelson and Morley ("Phil. Mag.," 24, p. 449) will make it appear that until more sensitive adjustments have been made it is not competent to decide as to the relative rest or motion of the earth and the ether.

RECENT DETERMINATION OF MAXWELL'S RATIO. Lamotte. "L'Eclairage Elec.," Jan. 22.—A description of the recent researches of Hurmuzescu and of Miss Maltby for determining the relation known as v between the electromagnetic and the electrostatic system of units, which is considered to be the velocity of electromagnetic waves; the method of the former is described and illustrated, and the numerical factor in the result is 3.001, which is considered correct to nearly 0.001.

PHOTO-ELECTRIC PROPERTIES. Schmidt. "Wied. Ann.," 62, p. 407; abstracted briefly in the "Proc. Lond. Phys. Soc.," Dec.

ELECTROCHEMICAL ACTINOMETER. Rigollot. "Proc. Lond. Phys. Soc.," Dec.; a brief abstract from the "Jour. de Physique," 6, p. 520.—He describes the construction of an apparatus.

CONDENSER DISCHARGE. Garbasso. "Nuovo Cimento," 4, p. 15; abstracted briefly in the "Proc. Lond. Phys. Soc.," Dec.—He considers the discharge between two wires in parallel, each having a resistance and an inductance, but quite close together, and finds the partial current in the two paths; either is inversely proportional to the difference between its self-induction and the mutual induction.

STEADY MOTION OF AN ELECTRIFIED ELLIPSOID. Searle. "Proc. Lond. Phys. Soc.," Dec.—A reprint in full of his long mathematical paper, an abstract of which was noticed in the "Digest," July 17.

DISTRIBUTION OF ELECTRICITY ON THE SURFACE OF A RING. Boulgakoff. "Proc. Lond. Phys. Soc.," Dec.—A long abstract of the article noticed in the "Digest," Aug. 28.

HEAT AND ELECTRIC CONDUCTIVITY OF CARBON. Cellier. "Phil. Mag.," Jan.—A short abstract, with the table of data, of his recent article from the "Wied. Ann.," No. 7.

POTENTIAL AT THE TERMINALS OF AN INDUCTION COIL. Oberbeck. "L'Eclairage Elec.," Jan. 22; abstracted from the "Wied. Ann.," 62, p. 109.—A long abstract of the article noticed in the "Digest," Nov. 6.

INSULATED CONDUCTOR IN A HIGH-FREQUENCY FIELD. Ebert and Wiedemann. "L'Eclairage Elec.," Jan. 15; abstracted from the "Wied. Ann.," 62, p. 174.—Illustrated descriptions of some interesting experiments made with an insulated conductor placed in a high-frequency field, and the light effects produced under those circumstances.

VACUUM TUBES. Wiedemann and Ebert. "L'Eclairage Elec.," Jan. 15; abstracted from the "Wied. Ann.," 62, p. 187.—They show the conditions under which a tube containing rarefied gases ceases to be illuminated in a field of high frequency; they also describe phenomena in rarefied gases contained in a nearly closed metallic receptacle in a high-frequency field

MUTUAL INFLUENCE OF CATHODE RAYS. Bernstein. "Wied. Ann.," 62, p. 415; noticed briefly in the "Proc. Lond. Phys. Soc.," Dec.—He describes experiments which tend to prove that the effect does not depend on the direction of the rays, but is exerted on the beam by the cathode itself.

VELOCITY OF CATHODE RAYS. Majorana. "Rend. Acc. Linc.," 6, p. 66; noticed briefly in the "Proc. Lond. Phys. Soc.," Dec.—He describes experiments, and obtained the values 6 multiplied by 10 to the seventh power cm per sec.

HOMOGENEOUS CATHODE RAYS. Deslandres. "Comptes Rendus," 125, p. 373; noticed briefly in the "Proc. Lond. Phys. Soc.," Dec.

DEFLECTION OF CATHODE RAYS. Kaufmann. "L'Eclairage Elec.," Jan. 15.—An abstract, with an illustration, from the "Wied. Ann.," 61, p. 544.—He shows the relation between the potential of the discharge and the deflection of cathode rays by a magnetic field.

CATHODE AND RONTGEN RAYS. Perrine. "Proc. Lond. Phys. Soc.," Dec.; abstracted briefly from the "Ann. Chim. et Phy. sique," 11, p. 496.—He gives a historical survey and discussion of experimental results.

MECHANISM OF THE DISCHARGE BY X-RAYS. Sagnac. "L'Ind. Elec.," Jan. 25.—An abstract of an Academy paper.

LENARD RAYS. Des Coudres. "L'Eclairage Elec.," Jan. 15; an abstract, with illustrations, from the "Wied. Ann.," 62, p. 134.—He describes a simple apparatus (already referred to in these columns) for the production of Lenard rays, and researches with these rays.

MAGNETIC FIELD DUE TO A CURRENT PARALLEL TO A CYLINDER. Searle. Lond. "Elec.," Jan. 28.—The first part of an article of a mathematical nature, in which he examines, from the point of view of the magnetic theory, the distribution of magnetic forces due to a current in a wire parallel to the axis of an iron cylinder; this he was led to by the recent discussion as to the origin of the mechanical force on a tunnel-wound armature. He shows that the mechanical force on the wire is then much smaller than it would be if it was outside of the iron, while the E. M. F. in the wire remains the same; he discusses the manner in which the force gets hold of the iron; he points out the part which the ether plays in producing this force; he considers that there is nothing in electro-magnetism more strange than that the current thus causes a large force to act on the iron, while the conductor experiences only a small one, it having been transferred by means of the mechanism of the ether.

JAMIN MAGNETS. Ascoli. "Rend. Acc. Linc.," 6, p. 71; noticed in the "Proc. Lind. Phys. Soc.," Dec.—He deduces a theory based on the geometry of hysteresis curves, explaining the relation between the magnetic moment of a single wire and a bundle.

ELECTRICAL RESISTANCE OF THIN FILMS. Stone. "Phys. Rev.," Jan.—A long article, describing extended researches. As there is a discrepancy between the measured and the calculated resistance of films, he made the present experimental investigation; the calculated resistance is but a small fraction of the initial measured resistance, which latter, however, is not constant, decreasing with time, the final value comparing favorably with the calculated one. He experimented with silver deposited on glass, the thickness being calculated from the weight; some experiments indicate that electric currents produce a similar effect on the film as heat does.

CALCULATION OF ELECTRICAL RESISTANCE OF ALLOYS. Liebenow. "El'ty," Feb. 9.—The beginning of a translation of the article abstracted in the "Digest," Jan. 29.

RADIOGRAHY IN MEDICAL PROGRESS. Williams. "Pop. Sc. Mo.," Feb.—A brief abstract of a recent address in the "American Journal of Medical Science," Jan., giving an account of his past year's work. He shows that Röntgen ray apparatus must now be accepted as one of the valuable instruments in a physician's equipment.

RONTGEN RAYS. Rollins. "Elec. Rev.," Feb. 9.—He discusses the appearance of an anode which is not cooled; he describes the Williams tube, made of an aluminum bulb with a rubber stopper and a cooled anode, and describes a simple means of generating oxygen in Röntgen ray tubes.

THEORY OF MAGNETO-OPTIC PHENOMENA. Wind. "Phys. Rev.," Jan.—A translation in part of a recent paper read before a scientific society in Amsterdam.

ELECTRIFICATION OF THE ATMOSPHERE. McAdie. "Terrestrial Magnetism," June, 1897.—A summary of a few recent articles; he also gives a table of the work of the chief investigators, from the time of Franklin to the end of the eighteenth century.

EARTH'S MAGNETISM. Bauer. "Terrestrial Magnetism," June, 1897.—A short article on what he calls a remarkable law, which he deduces and confirms by observations; the law gives the relation between the mean value for the year of the diurnal range of the magnetic declination, the diurnal range of the inclination, and the magnetic latitude, and it gives the approximation of the first two in any space where the inclination is known. The law assumed in his diagrams is that the component of the deflecting forces producing the angular declination from the mean position is inversely proportional to the forces exerted on the needle by the earth's permanent magnetism.

EARTH'S MAGNETISM. Van Bennelen. "Terrestrial Magnetism," June, 1897.—An article in German entitled "The Non-Cyclic Effect und die Erdmagnetische Nachstoerung," in which he compares his own researches with those of Chree.

THE EARTH A GREAT MAGNET. Fleming. "Terrestrial Magnetism," June, 1897.—A reprint of his lecture, delivered in Sept., 1896, and noticed at that time in these columns.

SECULAR VARIATION EXPRESSIONS OF THE MAGNETIC INCLINATION. Littlehales. "Terrestrial Magnetism," June, 1897.—A table giving these expressions at various important maritime stations.

Electro-Chemistry and Batteries.

ELECTROLYTIC ZINC.—Lond. "Engineering," Jan. 21; reprinted in "Lond. "Elec.," Jan. 28.—A short article reviewing the present situation. There are now three processes in use industrially for extracting zinc, while one or two others are in the experimental stage; the most important is used at Broken Hill, N. S. W., in which the recovery of the silver, lead and zinc is impossible by the ordinary methods; the Ashcroft process is used on a large scale at Newcastle, N. S. W., since March; in this the ore is crushed, roasted and leached with ferric chloride or sulphate, which dissolves the zinc and precipitates the iron, while the residue contains the lead and silver; from the solution one-third of the zinc is then obtained by electrolysis; it is then passed through the anode chambers of the same vats, in the first third of which iron anodes and in the remainder carbon anodes are used, forming ferrous sulphur in the first and ferric in the latter, after which it is ready for further use in the leaching vats; the economic results are not as favorable as was anticipated, and unless it is more satisfactory it will be stopped; the diaphragm and the ferric hydrate precipitated are the weak points. The Siemens & Halske process resembles the above in general principles, except that sulphuric acid is used for leaching; lead anodes, zinc cathodes, and wooden diaphragms are used; it is being tried on a large scale at Illawarra, N. S. W.; it is much simpler than the other; the average energy efficiency is low, due to the acid. A process which has solved the economic difficulties, invented by Dieffenbach, is used at Duisburg, in Germany, where ninety tons of zinc are produced per month, and the plant is to be extended; after chlorinating and roasting, the ore is leached with zinc chloride, and the solution is then electrolyzed. Concerning electro-galvanizing, it is stated that the Cowper-Coles process is used by four English firms; in Germany two processes are worked in one of which an alloy of zinc with aluminum or magnesium is deposited. The chief difficulty in all is the formation of spongy zinc; very careful attention to details is required; the cost of preparing the articles is considerable; the electric method will be used only where specially smooth surfaces are required. The cost of the electrical energy for depositing one ton of zinc from zinc sulphate is estimated; theoretically, 2619 electrical horse-power hours are required; the average energy efficiency is 33 per cent., making a total of $16.25 as the minimum cost of the power, even when obtained from water; there is therefore not a wide margin for profit.

ELECTROLYTIC SEPARATION OF COPPER. Revay. "Zeit. f. Elektrochemie," Jan. 20.—The conclusion of his article (see "Digest, Feb. 5).

ALLOYS OF COPPER WITH POSITIVE METALS. Neumann. "Zeit. f. Elektrochemie," Jan. 20.—The conclusion of his article (see "Digest, Feb. 5). He arrives at the conclusion that alloys of copper with the more positive metals, such as nickel, cobalt, iron, zinc and aluminium, when used as the anode in a copper sulphate solution containing free sulphuric acid, may be separated electrolytically, copper alone going to the cathode, while the other metals remain in solution; the voltage must not exceed 0.5; the electrolysis must be stopped at a certain point; at a certain dilution the copper will be deposited in spongy form, and this cannot be prevented by the addition of free acid; it furthermore appears that the copper cannot all be removed from such sulphuric solutions; the rest of it is more cheaply obtained with hydrogen sulphide than by electrolysis.

EXTRACTING METALS AND ALLOYS BY ELECTRIC HEAT.—"Lond. "Elec. Rev.," Jan. 28.—A note, stating that the Aschermann process is being tried at Cassel, Germany. The metals are extracted from a mixture of the oxide of a metal and the sulphide of another, or of a metalloid, the object being to accelerate the reduction and to eliminate the carbon and other impurities; the metal is obtained in the form of an alloy, from which the more fusible one can be separated by distillation; sulphide of antimony is preferred as a flux.

METALLIC DEPOSITS. Winteler. "Zeit. f. Elektrochemie," Jan. 20.—A short article, in which he shows from previous researches of others that the hydrogen absorbed on the cathode deposit has a very important effect on the physical nature of the deposited metal, and that it affects the desirable qualities of adherency, thickness and polish of deposits; there is not only mechanical absorption, but in some cases a true alloying. He refers chiefly to the properties of palladium, iron and platinum.

ELECTRO-CHEMICAL TREATMENT OF ORES OF PRECIOUS METALS. Webber. Lond. "Elec. Eng.," Jan. 28.—The first part a reprint of an Institution paper, in which he gives an illustrated history of the subject, beginning with 1843.

ELECTROLYTIC ANALYSES. Arth. "L'Eclairage Elec.," Jan. 15.—He discusses the case of the metals which are precipitated by ammonium sulphide.

ALLOYS OF GLUCINUM AND COPPER. Lebeau. "L'Eclairage Elec.," Jan. 15.—An abstract of an Academy paper, showing how this alloy may be obtained in the electric furnace.

CARBIDE OF CALCIUM FOR PREPARING ABSOLUTE ALCOHOL. Yvon. "L'Eclairage Elec.," Jan. 15.—A brief abstract of an Academy paper.

USE OF CALCIUM CARBIDE. Moissan. "L'Eclairage Elec.," Jan. 15.—An abstract of an Academy paper on the use of this material for preparing metallic carbides and for obtaining metals

CHANGES OF CONCENTRATION PRODUCED BY ELECTROLYSIS. Kohlrausch. "L'Eclairage Elec.," Jan. 15; abstracted from the "Wied. Ann.," 62, p. 209.—A long abstract of the mathematical article which was noticed in the "Digest," last week. A long English abstract is also published in the "Proc. Lond. Phys. Soc.," Dec.

CHEMICAL PROCESSES IN GALVANIC BATTERIES. Heil. "Elek. Zeit.," Jan. 20.—A brief abstract of a recent paper, in which he discusses the theories of the processes in galvanic batteries, and mentions some new cells to which this led him. They do not seem to be of special importance; one is a large Leclanché with a zigzag form of carbon, which gave 30 to 35 amperes, being therefore a substitute for the troublesome Bunsen cells; another is a dry cell of zinc and carbon, the latter surrounded with peroxide of lead, in a solution of zinc sulphate neutralized with sodium carbonate; the E. M. F. is 1.75 volts. A secondary dry cell is described with peroxide of manganese, carbon and spongy lead, the solution being some chloride; it will keep its charge almost indefinitely; the voltage is about 1.

THEORY OF REVERSIBLE BATTERIES. Darrieus. "L'Eclairage Elec.," Jan. 22.—The first part of a very long article on his chemical theory of lead accumulators. The present portion consists entirely of a long quotation from an article on his theory, read before the International Society in 1892; this is to be followed by descriptions of new experiments made subsequently, which confirm the probability of his theory.

MANUFACTURE OF ACCUMULATORS.—Lond. "Elec. Rev.," Jan. 28.—A well-illustrated description of the plant of the Tudor Company, at Dunkinfield, in England.

Units, Measurements and Instruments.

DETERMINING THE EFFICIENCY OF CONTINUOUS CURRENT DYNAMOS. Dupuy. "L'Eclairage Elec.," Jan. 22. —A brief description of a new method which he suggested. It requires the use of two similar dynamos; these are connected in parallel with low-resistance conductors; their armatures are furthermore rigidly connected by a coupling; the current from a third dynamo is then sent into these; if, for instance, the machines to be tested are for 140 kilowatts, at 140 volts, it will suffice that the third dynamo has a capacity of 28 kilowatts, at 140 volts; while the machines are running the excitation of one is altered, so that the equilibrium is disturbed, one of them becoming a generator and the other a motor; the current circulating between them is then made equal to their output, which in the example is 1000 amperes; the two machines are therefore running with their normal load, and their losses are supplied by the third machine; the current and voltage of the third machine are measured, and thus give the total losses of the two under test, the loss in each being one-half of this. It is supposed that the efficiency of the two machines is equal, which is not quite correct, as one is a motor and the other a dynamo, but the error is negligible; there is another cause of error which is also negligible, especially in large machines; the watts furnished by the third machine include a certain resistance loss, which, however, is very small. The method is especially applicable for measuring large units, and has the advantage of being rapid, and requiring but few instruments, which are found in every laboratory.

MEASURING A CAPACITY WITH A BALANCE. Peukert. "Elek. Zeit.," Jan. 20.—A short article, describing his experience with a new method proposed by Lang, which, he thinks, could be used in many cases in practice, as it is not only simple, but requires but little apparatus. The principle of the method follows from the well-known Thomson alternating current researches; there is a stationary coil through which an alternating current passes, and above this a second one suspended from one arm of a balance; repulsion will be produced, owing to the phase shifting; if now the ends of the movable coil are connected with the two parts of a condenser, such a phase shifting will be produced that there will be an attraction, from the amount of which the capacity of the condenser can be calculated. The formula is given. The present writer then made experimental researches in order to see whether the formula is correct; the results are given, and show that the formula can be used; the method is of special advantage for large condensers, and the results are sufficiently accurate for most practical purposes; the only instruments required are an amperemeter and a balance; a known capacity enables the constants in the formula to be determined.

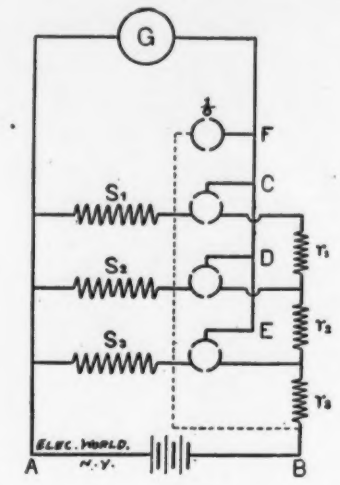
PROTECTING INSTRUMENTS AGAINST VIBRATION. Broca. "L'Ind. Elec.," Jan. 25.—An abstract of a French Physical Society paper. He investigated the various methods of protecting instruments; soft-rubber cushions give the worst results; for a galvanometer the Julius suspension system should be used; a heavy plate is suspended by three wires, and is provided with plates dipping in oil, to be used as dampers; the suspended system in a galvanometer should be as long as possible; soft rubber gives excellent results when the oscillations have a long period.

PROTECTING INSTRUMENTS AGAINST VIBRATION. Lindeck. "Zeit. fuer Elek.," Jan. 23.—An illustrated description of the Julius apparatus, descriptions of which have been referred to before in the "Digest."

COPPER VOLTMETER. Forester. Lond. "Elec. Eng.," Jan. 28.—An abstract, reprinted from the "Chemical Journal," of the article noticed in the "Digest," June 19.

MEASURING THE INSULATION OF ALTERNATING CURRENT CIRCUITS. Wilkens. "L'Ind. Elec.," Jan. 25.—A French translation of the article noticed in the "Digest," Jan. 1.

COMPENSATION SHUNT BOX. Stine. "Am. Jour. of Sc.," Feb.—The usual way of compensating for the shunt of a galvanometer so as to keep the resistance the same is to insert compensating resistances in series with the galvanometer. In the present short article he shows how these resistances are calculated, and it involves such a tedious process that there is doubt as to the accuracy of the final numbers; by rearranging the connections, and



using three-part sockets, he shows that a great simplicity is introduced into the calculations for a given set of shunts; the arrangement is shown in the accompanying diagram; the methods for calculating them are given; the difficulties in the usual method arise from the fact that the resistances are introduced into the circuit to be shunted.

MEASURING MEAN HORIZONTAL CANDLE POWER. Mathews. "Phys. Rev.," Jan.—A short article describing an experimental comparison of the two methods used for incandescent lamps, one by the point by point method, and the other by rotating the lamp. It has been thought that the two methods should give the same results, and his experiments were made to confirm this. The results are given, and show an agreement which was entirely within the limits of errors; the two methods, therefore, give the same results, provided there is no color difference.

ELECTRIC CURVE TRACER. Rosa. "Phys. Rev.," Jan.—A long illustrated description of the apparatus, of which a preliminary account was published in The Electrical World, Vol, 30, p. 631.

Telegraphy, Telephony and Signals.

SIGNALING WITHOUT CONNECTING WIRES. Lodge. Lond. "Elec. Rev." and "Elec.," Jan. 28.—An abstract of a recent Physical Society paper, the former journal containing a diagram of one of the arrangements described. He prefers the above term to "wireless telegraphy." The first thing necessary is to have a persistent vibation which can be tuned to, and not one that dies off rapidly and irregularly; this excludes the Righi transmitter; capacity is necessary, and the period can be altered by varying either the capacity or the self-induction, both of which he uses in his system, tuning with the latter; the receiver is a real resonator, and not a mere collector; the most novel feature is a coil of copper introduced between the two triangular wings; the waves used are over 30 yards long, thus shortening the shadows of an obstacle of moderate size, as the Hertz waves would bend around it like a sound wave; the length of Marconi's waves is about 4 feet; the coherer may be reduced with advantage to a single contact, for instance, a needle pressed against a flat spring, which is the most sensitive of all coherers, and requires no mechanical tapping; under certain conditions, it is too sensitive. It is editorially suggested that the coherer may be rendered sensitive to light. The instrument illustrated diagrammatically is capable of being used both as a transmitter or receiver.

WIRELESS TELEGRAPHY. Voisenat. "L'Eclairage Elec.," Jan. 22.—An abstract of a recent paper read before the International Society, giving a history of wireless telegraphy.

TELEGRAPH STATISTICS.—"Elek. Zeit.," Jan. 20.—An editorial making deductions from the official statistics for the year 1896 in comparison with the previous year, but referring only to the European countries, some of which are omitted. They are placed in the order of the number of sq. km. per telegraph office, Luxemburg heading the list with 19.4; then Switzerland with 22.1; Germany, 25.2; Belgium, 29.4; Great Britain, 30.9; Netherlands, 37.5, and France, 45.1. The number of telegrams per 100 inhabitants is also given, it being greatest in Great Britain, 207.8; the number of km. of wire per sq. km., the number of inhabitants per sq. km., and the number of metres of wires per inhabitant are also given.

CURRENT FOR TELEGRAPHY AND TELEPHONY. Ritter and West. "Elek. Zeit.," Jan. 27.—The first part of an illustrated article describing the installation of accumulators for the main telegraph and telephone offices in Stuttgart.

INDEPENDENT TELEPHONE COMPANY IN DETROIT. Grace. "Elec. Eng.," Feb. 3.—A long illustrated description of this

plant, which is said to be the largest one of the independent telephone companies in the country, the capacity, when completed, being 10,000 drops. The charge is $40 for business purposes and $25 for residences.

SEMAPHORE SIGNALS.—"El'ty," Feb. 9.—A brief description of several new forms.

Miscellaneous.

FATAL E. M. F. Hedley. Lond. "Elec. Rev.," Jan. 28.—A brief review of the four fatal cases recently described in the "Digest," concluding that the minimum fatal E. M. F. has yet to be defined, and with the definition must also come a statement of the conditions; he believes that all commercial currents are dangerous under certain conditions, which, however, do not often occur and can easily be remedied. They would be met by a concentric system with the outer conductor earthed and with the switches on the inner one.

DANGERS FROM ALTERNATING CURRENTS.—"Zeit. fuer Elek.," Jan. 16.—An editorial referring to the recent results of Weber, and stating that the relations are in certain respects analogous to those in touching a flame; one can pass the hand rapidly through a flame, but dare not hold it there; alternating circuits of low voltage should therefore not be prohibited any more than the gas flames; a warning should be given, however, against taking firm hold of such circuits; in the primary circuits there is also static electricity, the greater part of which can be led to the earth by touching the circuit, even when the whole circuit is insulated.

ELECTRICAL ENERGY IN THERAPEUTICS. Chatzky. "L'Elec.," Jan. 8.—A reprint of a paper read before the International Congress of Medicine at Moscow.

POSSIBILITIES OF ELECTRIC HEATING AND COOKING. Adams. Lond. "Elec. Eng.," Jan. 28; in abstract in Lond. "Lightning," Jan. 27.—A reprint of a paper read before the Northern Society of Electrical Engineers. When the cost of the current is somewhat modified electric cooking is well within the range of those with average incomes; an idea of the current and equipment of a kitchen for supplying eight to ten persons is given; the methods of charging at present used are discussed, and the effect of a day load on the central stations is pointed out; electric heating by radiators is discussed. He believes that there is a reasonable probability of a considerable development in the near future.

CURRENT INTENSITY OF LIGHTNING. Pockels. "Wied. Ann.," No. 63; abstracted in the Lond. "Elec.," Jan. 28.—From some investigations of the magnetic properties of basalt, he made an approximate determination of the current intensity of a lightning flash. The local magnetizations are assumed to be due to atmospheric electricity passing along the surface of the rock; from the magnetic moment of the rods cut from the rock along its magnetic axis he estimated the current strength of the discharge which produces the magnetization. He found the intensity of magnetization to be 0.4 per cu. cm., and after demagnetization the same permanent intensity was imparted by a field of 290 units; a current of at least 2900 amperes was therefore required to product the effect.

AMBROIN. Montpellier. "L'Elec.," Jan. 8; abstracted in the Lond. "Elec. Rev.," Jan. 21, and Lond. "Elec. Eng.," Jan. 14.—A long description of a new insulating material made of a mixture of fossilized resins, asbestos, mica, etc., in proportions varying according to the qualities desired; the material is finely pulverized, mixed and subjected to a chemical treatment, which is not described; it is then placed in moulds of steel, where it is subjected to the combined action of heat and great pressure; the homogeneity is perfect, and the moulds come out with a brilliant polish; the density is 1.2 to 1.7; other properties, such as the absorption of moisture, etc., are given; it absorbs very little, is not acted upon by sulphuric acid, and can therefore be used for accumulator cells; it offers great resistance to tension and compression.

OZONE. Andreoli. Lond. "Elec. Rev.," Jan. 28.—A short article in reply to recent sarcastic statements by Swinburne concerning statements and claims of makers of ozone. The present writer points out some of the difficulties involved in ozone manufacture.

SPRENGEL PUMP. Guglielmo. "L'Eclairage Elec.," Jan. 22.—An abstract of an article from the Italian, describing some simplified forms.

PRIZES.—"L'Ind. Elec.," Jan. 25; "L'Eclairage Elec.," Jan. 22, and "L'Elec.," Jan. 29.—A list of some of the prizes for 1897 awarded by the French Academy. The La Caze prize was awarded to Lenard; the Planté prize to Blondel; the other La Caze prize to Röntgen; the Montyon prize jointly to Remi and Contremoulins and to Marie and Ribaut.

SCIENTIFIC PROGRESS IN THE CLOSING CENTURY. Buechner. "Pop. Sc. Mo.," Feb.—An article reviewing the progress in the various branches of science, including some references to the electrical branch.

Book Reviews.

LEÇONS SUR L'ÉLECTRICITÉ (LESSONS IN ELECTRICITY). By Eric Gerard; fifth edition; two volumes; large octavo; 800 and 770 pages; 375 and 378 illustrations. Published by Gauthier-Villars et Fils, Paris, France.

While this excellent work is especially designed for engineers, it is no less interesting from the point of view of the pure scientist. The accuracy and elegance of its theories and its broad treatment of the field of applied engineering are equally characteristic of it. The former editions of this work have been well known to engineers for several years. This fifth edition has been brought up to date (1898), and will be found to contain much new and highly interesting matter. The first volume is given over to the discussion of the general laws of electricity, which are developed by somewhat elaborate mathematical treatment. Beginning with a short exposition of the theory of potential and Gauss' theorem, the application of the general theorems for central forces follow and lead up to the applications of the theory of potential. In the chapter relating to batteries special attention is given to the important case of accumulators. No less than 340 pages of this first volume are occupied by the discussion of dynamos and transformers, the subject being elaborately and completely developed.

The second volume is devoted to applications of electricity in the arts. In the chapter on rotary transformers appears a good description of the machine devised by Messrs. Hutin and Leblanc, which possesses special interest in that its output per unit of weight is greater than that of any other similar machine. The chapters upon alternating current motors are very full and interesting. The theory of non-synchronous motors has been worked over since the last edition, and contains an example of the design of a tri-phase motor after the method given by Kolben. The remainder of this volume is given over to descriptions of machines and methods. It will probably remain for a long time the standard work of its kind in France—a position it has well earned. It is unfortunate that, in so elaborate and valuable a work, old and unsuitable illustrations should have been used, greatly marring the beauty of the text. In many cases the figures consist of direct reproductions of what are evidently sketches containing the roughest possible figures and reference letters, and altogether reflecting little credit upon the taste of the publishers.

ELEKTROMECHANISCHE KONSTRUKTIONEN, eine Sammlung von Konstruktionsbeispielen und Berechnung von Maschinen und Apparaten für Starkstrom. (Electro Mechanical Construction, a collection of calculations and construction details of heavy current machinery and apparatus.) By Gisbert Kapp; double octavo; cloth; 200 pages; 54 illustrations and 25 large plates. Published by Julius Springer, Berlin.

This sumptuous volume is composed of a series of elaborate detailed descriptions of European dynamo machinery and appliances. In each case all the data of construction, winding, etc., are fully given, and form, with the plates, practically a working specification of the particular machine. The work bears evidences of the greatest care in its production, and its typography is magnificent. While the foreign machines, with a few exceptions, are quite unlike American types, they should be studied by all designers of dynamos, etc., and this can be done nowhere to better advantage than in Mr. Kapp's handsome volume.

WITH MALLET AND IRON. A Narration in German of the Miner and His Technical Helps. By Dr. Wilhelm Bersch. Fully illustrated. Published by A. Hartleben, Vienna, Austria. Five parts, 70 cents.

The work of the miner, as also the remote location of the mines, gives great interest to information of the mining industry, which has seldom been put before the public. Heretofore, popular literature has not taken up this subject, and these volumes explain the peculiar work of the miner and his technical instruments, as well as the results of work with the raw material which he takes from the earth, and also the history of similar work in the past and the methods used by the miner long ago. The application of iron in the electrical arts is described and illustrated by examples from the best modern German practice.

A POCKET DICTIONARY OF ELECTRICAL WORDS, TERMS AND PHRASES, by Edwin J. Houston; 16mo; 945 pages; leather; $3. The W. J. Johnston Company, New York, publishers. Price (cloth) $2.50.

This little book is an epitome of Dr. Houston's larger work, now the standard book of its class. In the small compass of this volume there are over 12,000 definitions of electrical terms and words, many of them of the most recent origin. They are arranged alphabetically, without cross-references, which were avoided for the sake of economy of space. The book is an excellent manual for students, and presents more valuable information in smaller compass than any other work of its kind.

WRIGHT'S TRADE DIRECTORY AND GAZETTEER FOR AUSTRALIA, INDIA, CHINA AND JAPAN. Fifth edition. Including Canada and other English Colonies. Cloth. Price, $5. Published by George Wright, 121 Fulton Street, New York.

This new edition of the well-known colonial trade directory contains valuable information as to the tariffs of the various countries of which it treats, distances, routes, etc., besides a full line of business men indexed according to their occupations. The information concerning each country treated is printed upon a different color of paper, to facilitate ready reference.

THE POTENTIOMETER AND ITS ADJUNCTS. By W. Clark Fisher. Cloth, 12mo, 194 pages, 88 illustrations. Published by the D. Van Nostrand Company, New York. Price, $2.25.

This book is for the most part compiled from articles contributed by the author to the London *Electrician*. It consists mainly of a thesis upon the Crompton potentiometer, but seems a practical and, in many respects, an excellent treatise upon potentiometer methods in general.

Interesting Electric Light Installations.

At the Springfield, Ohio, water works there is an electric light plant that possesses some extremely interesting features. The location of the water works is at such a distance from the city that it was found impracticable to bring current from the station in the city. It was decided therefore, to install an isolated plant to light the water works, and the illustration, Fig. 1, represents the combination of dynamo and water wheel which is now operating there with the best of satisfaction and economical results. The dynamo is of forty lights capacity, and coupled direct to a 12-inch Leffel Cascade wheel, which is connected to the main service pipe inside of the station. Under 70 pounds pressure, which is the minimum of the station, the machine runs thirty 16-cp lights at 110 volts. With a twenty-one thirty-second of an inch jet it gives a theoretical flow of 90 gallons per minute, making a total of 54,000 gallons in ten hours, run at an annual cost of 23 cents per 1000 gallons for coal burned while pumping, all other charges, such as salaries, banking fires, etc., remaining a constant. This shows the exact cost to the water works of running thirty lights ten hours to be 12.42 cents.

The Cascade motor has five different size jets, namely, five-sixteenths of an inch, nine-sixteenths of an inch, twenty-one thirty-seconds of an inch, eleven-sixteenths of an inch and twenty-three thirty-seconds of an inch in diameter, all made on the smooth taper plan. The nozzles are all in one brass disc, 4 inches thick, bored longitudinally, the disc being 5 inches in diameter. The jet whose size is best adapted for the load can be brought into play by turning the handle on the disc, automatic regulation not being necessary in a small plant. The jets are laid off in a circle having six spaces, one being left blank to close the main opening when not in use. The generator was built by the

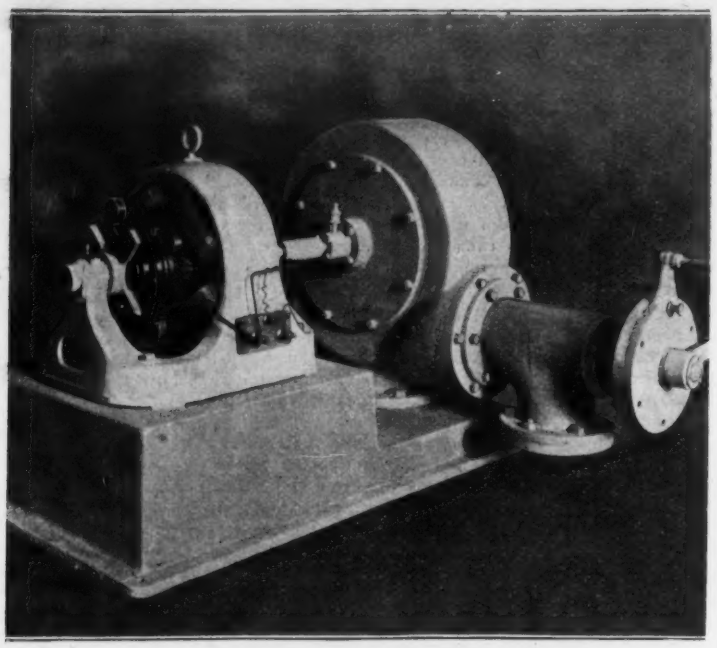


FIG. 1.—GENERATING UNIT AT THE SPRINGFIELD WATERWORKS.

Triumph Electric Company, Cincinnati, Ohio. It is of the multipolar type, compound wound, and runs at a speed of 80 revolutions per minute.

The James Leffel & Co. state that this installation has given such successful results that it has led to the adoption of a similar one, but of about three times the capacity, at the water works in Columbus, Ohio. In such locations the economy of water power over a separate small engine for driving the dynamo is evident, owing to the high steam economy of the main pumps, the losses of the wheel being slight.

The plant at the Columbus Water Works is also illustrated (Fig. 2). The dynamo has a capacity of 100 lights, and is driven by an 18-inch Cascade wheel,

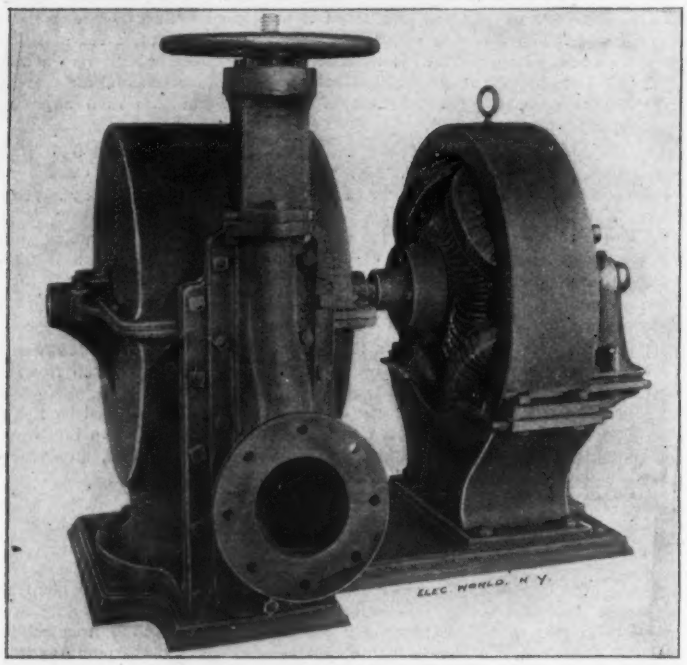


FIG. 2.— GENERATING UNIT AT THE COLUMBUS WATERWORKS.

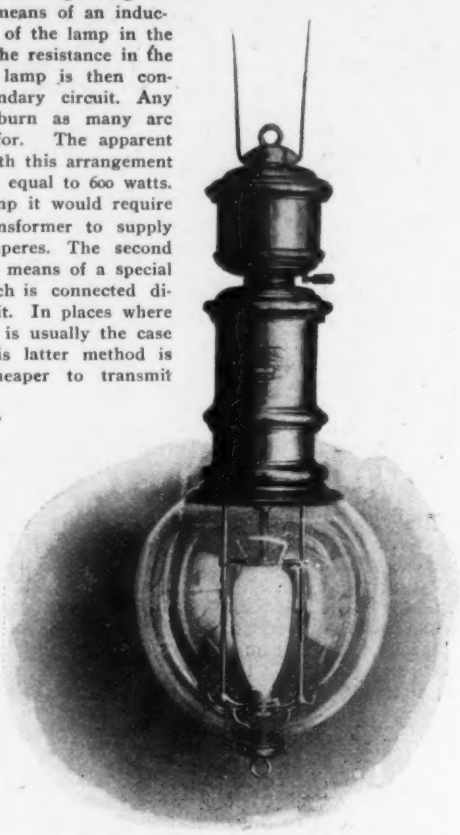
with three nozzles, the gate operating each of these separately. The design of the gate or nozzle arrangement is different to that of the Springfield machine.

Under ordinary conditions, or where the pressure is quite steady, there is usually no necessity of a governor for automatic regulation. A governor would require throttling of the stream more or less, and a far less efficiency would be attained. Besides, the cost of a governor is saved, and this amounts to quite as much as the cost of the wheel itself.

A New Long-Burning Alternating Arc Lamp.

The Fort Wayne Electric Corporation, Fort Wayne, Ind., is putting on the market a new "Wood" long-burning alternating arc lamp, which is said to possess features of merit. An illustration of this lamp is presented herewith.

There are two methods of regulating the "Wood" lamp—one is by means of an induction coil placed in the top of the lamp in the place usually occupied by the resistance in the direct current lamp. The lamp is then connected to a 100-volt secondary circuit. Any 100-volt transformer will burn as many arc lamps as it has capacity for. The apparent energy taken by a lamp with this arrangement is six amperes at 100 volts, equal to 600 watts. That is to say, for one lamp it would require at least a twelve-light transformer to supply the 100 volts and six amperes. The second method of regulation is by means of a special arc light transformer, which is connected directly to the primary circuit. In places where the lamps are scattered, as is usually the case in out-of-door lighting, this latter method is preferable, since it is cheaper to transmit energy by means of a high pressure primary wire than by means of the larger wires necessary when using the low pressure secondary. Another advantage is the doing away with the induction coil necessary when the lamp is placed on a constant potential 100-volt circuit, thus saving from 25 to 50 watts loss in the induction coil. Wherever there is need of but one or two lamps in a place a little greater efficiency is obtained and the expense of the induction coil is saved by using the special arc-light transformer, since it is always necessary to have a transformer in either case. In store lighting, however, where several lights are required and where there may be an objection to bringing the high pressure wires into the building, the former method is the better one, the real efficiency being nearly as great when the lamps are burned from the large transformer. Either method may be used for indoor or outdoor work. Although the real energy taken by the lamp when burning on a constant potential circuit is only 425 watts, the apparent energy is 600 watts, and the lamp takes from the capacity of the transformer on which it is running that amount of energy.



NEW ALTERNATING ARC LAMP.

In case of a lamp burning on a special arc-light transformer the apparent energy is represented by six amperes x 70 volts, which is only 420 watts apparent energy, the real energy being about 400 watts taken from the primary circuit.

The lamps are made for six amperes; with less current than this the light would be so small as to be unsatisfactory. They are wound for one current only, although it is possible to arrange them to take different currents by changing the windings. This, however, is not advisable.

The advantages claimed for this lamp may be enumerated as follows: Handsome appearance and finish; perfect ventilation, while at the same time weatherproof; the switch is placed at the most convenient position, and is substantial in construction; the feed mechanism is exceedingly simple, requiring no adjustment and feeds the carbons perfectly; the use of a universal carbon holder, permitting the centering of carbons producing no strain on the feed rod, and novelty in the manner of supporting the globe, doing away with the sliding rods.

Exhibitors at the Coming Electrical Exhibition.

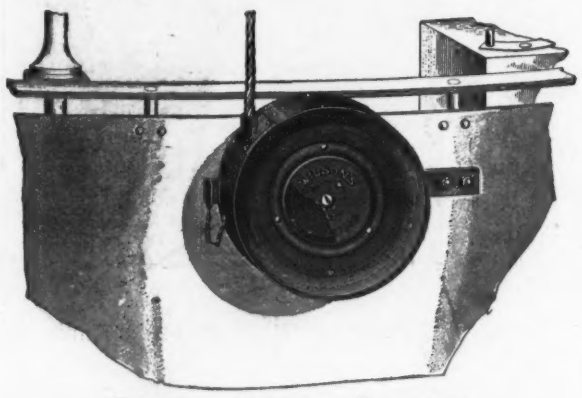
Following is a partial list of individuals and firms who have secured space for exhibits at the Electrical and Kindred Industries Exhibition, which will be held at Madison Square Garden, New York, during the month of May next:

Armorite Interior Conduit Co., Pittsburg, Pa.
American Rheostat Co., Milwaukee, Wis.
American Electric Cold Supply Co., Brooklyn, N. Y.
American Pulley Co., Philadelphia, Pa.
American Watchman's Time Detector, New York.
American Engine Co., Bound Brook, N. J.
Adams-Bagnall Electric Co., Cleveland, Ohio.
Armington & Sims Co., Providence, R. I.
American Electrician Co., New York.
American Electrical & Maintenance Co., New York.
American Electrical Works, Providence, R. I.
Bullock Electric Co., New York.
Bossert Electric Construction Co., Utica, N. Y.
Baylis Co., The, New York.
Bernard Co., E. G., Troy, N. Y.
Borne, Scrymser Co., New York.
Belknap Motor Co., Portland, Me.
Brewster Engineering Co., New York.
Crocker-Wheeler Electric Co., New York.

C & C Electric Co., New York.
Corey, R. B., New York.
Coho & Co., H. B., New York.
Christensen Air Brake Co., Milwaukee, Wis.
Card Electric Co., Mansfield, Ohio.
Cleveland Twist Drill Co., Cleveland, Ohio.
Crouse-Tremaine Carbon Co., Fostoria, Ohio.
Connecticut Telephone & Elec. Co., Meriden, Conn.
Crown Woven Wire Brush Co., Salem, Mass.
Cook Sons, Adam, New York.
Campbell Underground Trolley Co., Towanda, Pa.
Camp Co., H. B., Aultman, Ohio.
De La Vergne Refrigerating Co., New York.
Diamond Electric Co., Peoria, Ill.
Diesel Motor Co. of America, New York.
Edison, Thomas A., Orange, N. J.
Edison Electric Illuminating Co., New York.
Eddy Electric Mfg. Co., Windsor, Conn.
Electric Storage Battery Co., Philadelphia, Pa.
Excelsior Electric Co., New York.
Edison Mfg. Co., New York.
Edison, Jr., Thomas A., New York.
Electrical Engineer, New York.
Electrical Review, New York.
Electrical Age Publishing Co., New New York.
Electricity Newspaper Co., New York.
Fischer Foundry & Machine Co., Pittsburg, Pa.
Fort Wayne Elec. Corporation, Fort Wayne, Ind.
Fuel Economizer Co., Matteawan, N. Y.
Fostoria Incandescent Lamp Co., Fostoria, Ohio.
Fiberite Co., Mechanicville, N. Y.
Fairchild & Sumner, New York.
Gold Car Heating Co., New York.
Harrison Safety Boiler Works, Germantown Junction, Philadelphia, Pa.
Highland Chemical Co., Connellsville, Pa.
Haines Co., Wm. S., Philadelphia, Pa.
Haring Steam Plant Equip. Co., New York.
Ideal Electric Corporation, New York.
Imperial Porcelain Works, Trenton, N. J.
India Rubber & Gutta Percha Insulating Co., Glenwood, N. Y.
Jones & Son, J., New York.
Johnston Co., The W. J., New York.
Keuffel & Esser Co., New York.
Kelley & Sons, B. F. New York.
Keystone Electrical Instr. Co., Philadelphia, Pa.
Lawrence Machine Co., Lawrence, Mass.
Lewis Tool Co., New York.
Lynn Incandescent Lamp Co., Lynn, Mass.
Morris, Elmer P., New York.
Machado & Roller, New York.
Mowrey & Co., P. M., New York.
Niles Tool Works Co., Hamilton, Ohio, and New York.
National Meter Co., New York.
Nowotny Electric Co., Cincinnati, Ohio.
National Carbon Co., Cleveland, Ohio.
Nash Gas Engine Co., New York.
New Britain Mach. Co., New Britain, Conn.
N. Y. Safety Steam Power Co., New York.
Oswego Boiler Works, Oswego, N. Y.
Otis Electric Co., New York.
Onondaga Dynamo Co., Syracuse, N. Y.
Paragon Arc Lamp Co., Boston, Mass.
Peru Electric Mfg. Co., Peru, Ind.
Peckham Motor Truck & Wheel Co., New York.
Partrick, Carter & Wilkins, Philadelphia, Pa.
Paragon Motor Co., New York.
Porter & Remsen. New York.
Roebling's Sons Co., Jno. A., Trenton, N. J.
Safety Insulated Wire & Cable Co., New York.
Stephenson Co., Limited, John, New York.
Silex Insulation Co., New York.
Sprague Electric Co., New York.
Simonds Mfg. Co., Pittsburg, Pa.
Sinclair, D. J., Caledonia, N. Y.
Street Railway Journal Co., New York.
Translucent Fabric Co., Quincy, Mass.
Thomas & Sons Co., R., East Liverpool, Ohio.
United States Electrical Supply Co., New York.
Vacuum Oil Co., Rochester, N. Y.
Van Horne, Burger & Co., Dayton, Ohio.
Worthington, Henry R., New York.
Walker Co., Cleveland, Ohio.
Weston Electrical Instrument Co., Newark, N. J.
Warren Electric Mfg. Co., Sandusky, Ohio.
Williams & Co., J. H., Brooklyn, N. Y.
Wendell & MacDuffie, New York.
White, J. G., & Co., New York.
Western Electrician, Chicago.
Zimdars & Hunt, New York.

Trolley Pole Catcher and Reel.

When the trolley pole jumps the wire there is always danger of damage to the overhead structure, unless some means are provided to arrest the upward flight of the pole before it has a chance to do injury. The device illustrated



THE REEL APPLIED TO DASHBOARD.

herewith is born of the necessity for some such means. It is entirely mechanical in its construction, and that it is extremely simple is obvious at a glance.

This trolley pole catcher and reel, as it is called, consists of a case containing a long clock spring to which the trolley pole cord is attached. By the action of the spring the rope is kept constantly taut. In case the trolley wheel jumps the wire, the sudden effort of the pole to fly upward causes the dogs in the reel to move outward by the centrifugal force and catch in the teeth,

THE REEL.

thus arresting the motion of the cord. It is stated that the rope is in this way caught before it has moved 2 inches.

This trolley catcher is manufactured by Wilson, Thomson & Co., 313-315 Fulton Street, Brooklyn, N. Y. It has been tested on five different electric roads with satisfactory results. The device may be placed in the dashboard, although there are several ways of applying it. It is made in a durable manner.

Arc Light Voltmeter and Ground Detector.

The instrument illustrated herewith is a combination of an arc-light voltmeter and ground detector. By means of the voltmeter the actual voltage of each circuit is indicated or the total voltage of the generator, and consequently the number of lamps burning, and the ground detector will indicate a ground and determine its character and location. The character, resistance and location of a ground are determined by taking three readings and equating them in simple formulæ. The instrument may be used while the circuit is "alive," thus giving results under working conditions. It is self-contained, well made, accurate, reliable, dead beat, unaffected by external fields or changes in tempera-

COMBINATION VOLTMETER AND GROUND DETECTOR.

ture, and easy and safe to manipulate. In connection with a set of switches and a battery, or an ordinary incandescent circuit, the instrument may be used to test the continuity of the line and the resistance from line to earth during the day, and for this purpose will be found much easier to handle, more accurate in results, and quicker in action, than any galvanometer and bridge method.

The Keystone Electrical Instrument Company, Philadelphia, Pa., manufactures this apparatus, and claims that more testing can be actually accomplished from the switchboard by using this instrument, and more definite results obtained than with any other form of testing device heretofore offered. The expense of patrolling the lines every day looking for possible trouble is entirely obviated. All that is necesary is that the night attendant shall keep a

log of any bad grounds he may discover during the night's run and this report having been turned over to the "trouble man" in the morning, prompt repairs of defective insulation may be made.

Improved Bit for Electrical Work.

The Cleveland Twist Drill Company, Cleveland, Ohio, has just put upon the market an improved bell hanger's and lineman's bit, which will no doubt be of great service to electricians in wiring buildings and in other electrical work.

Improved Bit.

This bit is a twist drill, in which there are numerous holes made at equal distances in the centre rivet for the purpose of carrying wires through the partitions and other obstructions through which they have to go.

The new bit acts both as a drill and fish tool, thus simplifying the work and saving a great deal of time. When the bit is sent through the partitions the wire can be inserted without taking the bit out of the hole, and drawn back by the bit; or if going from the same side that the workman is on, there is a hole in the back of the shank through which the wire can be put after the bit has gone through the partitions, and by pushing the bit on through, the wire is carried with it. The bit is then withdrawn. Linemen who have used these bits claim that by the use of one of these improved drills a building can be wired in almost half the time that it required under the old method. These drills are made in all the different sizes and lengths required for linemen's use.

The Trans-Mississippi and International Exposition.

A Bureau of Electricity for the Trans-Mississippi and International Exposition has been organized, with Prof. R. B. Owens, formerly a commissioner of the Exposition, in charge as director.

Applications for space in the machinery and electrical buildings of the Trans-Mississippi and International Exposition, which will be held at Omaha, Neb., from June 1 to Nov. 1, this year, are rapidly coming in. The space taken already exceeds the dimensions of the buildings, and it will be necessary to make an exchange or build annexes to accommodate all. The same state of things is true with reference to other buildings and departments. Mr. Henry Ruston, of Omaha, is superintendent of light and electric power; Mr. J. A. Bromhall, of Omaha, is engineer in charge of the steam power. There will be used three 18 x 30 x 16 compound Westinghouse engines; one 24 x 24 Sioux Corliss engine, manufactured by the Murray Iron Works Company, Burlington, Ia.; one Imperial engine, 16 x 16, manufactured by the Weston Engine Company, Painted Post, N. Y., and one 16 x 16 engine made by the Buffalo Forge Company, Buffalo, N. Y. There will be four 600-hp and two 300-hp "Climax" boilers, built by the Clonbrock Steam Boiler Company, of Brooklyn, N. Y. These boilers were used at the Nashville Exposition. The electric generating plant will consist of four 125 arc light machines, three 120-kw, one 180-kw and one 300-kw incandescent machines, and one 280-kw power generator, all of the General Electric Company's make. There are seventeen carloads of wire and materials that were used at Nashville. Beside this the General Electric Company will furnish 109,000 feet of weatherproof wire, running as high as 00. The Safety Insulated Wire & Cable Company, of New York, will furnish 60,000 feet of rubber covered wire, ranging in sizes from No. 6 to 0000. This wire will be run in 13,000 feet of double duct and 20,000 feet of single duct. Ninety-three thousand feet of rubber covered wire running as high as 00 will be used for inside work. The lagoon, which runs east and west, is from 100 to 500 feet wide and 1000 feet long. It will be studded with incandescent lamps all around the water's edge, the lamps being placed 18 inches apart. The grand court around the lagoon will be illuminated by 151 arc lamps and 10,000 incandescent lamps. The rates for light and power will be as follows: Arc lamps, 2000 candle-power, for the season of five months, $72; incandescent lamps, 16 candle-power, $9 for the term; in addition to which will be charged the cost of installation. For motor installation, the charges will be: $25 for one-quarter horse-power or less; $35 for one-quarter to one-half horse-power; $45 one-half to 1 horse-power; $60 1 to 2 horse-power, and special rates for machines over 2 horse-power. The minimum rate will be $25. Ten dollars will be charged for the season for one-half horse-power under contract; $15 for 1 horse-power; $16.50 for 2 horse-power; $17.50 for 3 horse-power; $18.75 for 4 horse-power; $20 for 5 horse-power; $25 for over 5 and up to 20 horse-power. No fire or gas of any kind for light or power will be allowed upon the grounds; electricity will be used exclusively for light and power. The grounds cover 198 acres.

Work on the buildings has been steadily applied all through the winter, and the structures are, in consequence, very well advanced. The management is sparing no effort to make this exhibition a worthy successor of the World's Fair at Chicago in 1893, and that their expectations will be realized is evident from the number of applications that are coming in.

Sixty annual conventions will be held in Omaha during the Exposition term. These, of course, will bring to Omaha many people from all over the country.

New Line of Small Direct Current Motors.

The General Electric Company announces in a recent bulletin a new line of well designed and thoroughly constructed direct current motors of small capacity adapted to the direct application of power to small machines of all kinds. They have been given the designation of "Type C A," and in their design the production of an efficient motor, sufficiently light and compact to allow of installation in cases where space is limited, and absolutely rigid support unobtainable, has been kept constantly in view. A magnetic circuit, therefore, entirely of laminated iron, has been adopted, and greater lightness and compactness thus secured than would have been possible with cast iron.

The construction of the armature, commutator and field coils follows closely that in the standard General Electric railway motors. The laminated armature core is toothed and wound with the Eickemeyer type of coil. The leads from the armature are soldered directly into slots in the segments, and the field coils are thoroughly taped and mounted on laminated pole pieces. The armature can be withdrawn after taking off the pulley end bearing, and the field coils removed through an opening in the frame. In the larger machines the shaft is mounted on two similar swivel bearings, each self oiling. The brush holders are adjustable radially, and may be revolved around the commutator as required. The neutral point is very wide, however, and no adjustment of the brush holder is necessary. These motors are inclosed, and thoroughly protected from mechanical injury, but thorough ventilation is provided by holes in the bottom of the case and around the commutator end of the armature. Should these motors be used in places where flying dust necessitates extra protection, the commutator and brush holders may also be encased.

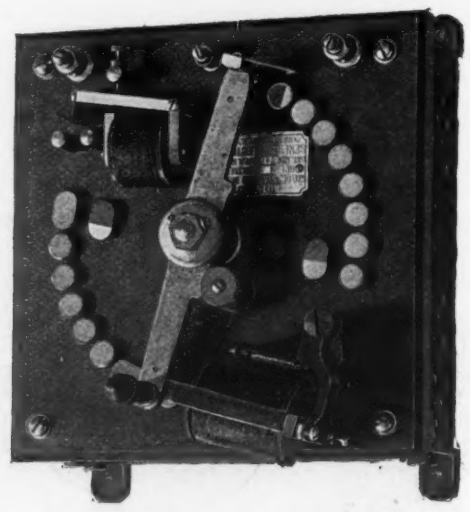
The speeds are lower than usual with motors of small capacity. Better provision for over load is thus given, and losses are not so great. The regulation, efficiency and disposition of the material in the "C A" motors also combine to give them a continued high economy. Heating tests show that they will run continuously with but slight increase in temperature, and even with a momentary overload of 100 per cent. little or no sparking is noticeable.

One feature of advantage of this motor is the possibility of placing it in almost any position with no greater change than the turning of the bearings to suit the position selected. The "C A" motor may be installed on the floor or be suspended from the ceiling, be set on a shelf or attached to a wall. In every case the oil cellar is at the bottom of the bearing.

The 1-hp and half-hp "C A" motors are designed for 115, 230 and 500 volt circuits; the one-eighth-hp are 115 volt circuits. The floor space for the first-named is only 22⅛ inches by 16½ inches, and for the half-hp motor 13¾ inches by 13 inches. The motors are finished in black with brush holders and small parts nickeled and polished.

One-Eighth-HP Type "C A" Motor.

One-Half-HP Type "C A" Motor.



Automatic Motor-Starting Rheostat.

For use with the larger sizes a new type of rheostat has been developed. It is provided with an automatic switch, which breaks the circuit in case of overload, and effectually protects the motor armature. The smaller sizes are series wound, and require no rheostat.

News of the Week

Financial Intelligence.

THE COLUMBUS STREET RAILWAY COMPANY has certified at Trenton, N. J., to an increase of capital from $400,000 to $1,000,000.

THE COLUMBUS STREET RAILWAY COMPANY, Columbus, Ohio, reports gross earnings for January of $53,788, an increase of $6919, as compared with the same month of last year, and an increase in net earnings of $5501.

THE BRIDGEPORT TRACTION COMPANY, Bridgeport, Conn., reports an increase of $4292 in gross earnings for the month of January, as compared with the same in January, 1897. The net increase for the same month was $3795.

THE BROOKLYN HEIGHTS RAILWAY COMPANY reports for the quarter ended December 31 last, gross earnings $1,110,371, an increase of $47,201 as compared with the same period for 1896. The operating expenses were $660,277, an increase of $27,480; net earnings, $450,094, an increase of $19,721.

THE BROOKLYN, QUEENS COUNTY AND SUBURBAN RAILROAD COMPANY reports for the quarter ended December 31, 1897, gross earnings, $186,795, an increase of $8759, as compared with the report for the same period the year previous; operating expenses, $106,260, decrease $9205; net earnings, $80,714, increase $17,963.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, Feb. 14, 1898.

ELECTRIC POWER IN PAPER MILLS.—At the annual meeting of the American Paper & Pulp Association at the Waldorf-Astoria Hotel, February 16, two papers will be read by well-known electrical engineers on the application of electricity in the paper industry. One of these papers, to be read by Dr. Louis Bell, is entitled "The Use of Electric Motors in Paper Making;" the other, by Charles F. Scott, is entitled "Electricity in Paper Making."

IT IS REPORTED that the Edison Electric Illuminating Company of New York has purchased the square bounded by Thirty-eighth and Thirty-ninth Streets, First Avenue and the East River, this city, on which it will erect a large electric generating plant. The price paid for the plot is stated to be $345,000. The company proposes, so we understand, to concentrate in this one plant its entire generating system, with the possible exception of the Duane Street station, the intention being to employ high-voltage transmission to distributing stations. This is in line with the tendency in modern central station practice in large cities. This system of generation and distribution has already been adopted by the Chicago Edison Company and the Brooklyn Edison Company, and its adoption in Manhattan Borough will mark an event of the greatest importance and interest to electrical engineers.

THE NEW YORK ELECTRICAL SOCIETY has just issued a pamphlet giving a list of the principal lectures delivered before that body during the past ten seasons. The programme for the present season includes papers on "The Influence of Electrical Railroads on Population and Land Values," by Frank E. Knight. After this paper Mr. W. J. Clark will give a practical demonstration of the Marconi system of wireless telegraphy, and Mr. John Dennis, Jr., will describe the operation of "The Fluorometer as a Surgical Adjunct of the X-Ray." Prof. S. H. Short will discuss "Evolutions in Electric Traction," and Prof. Elihu Thomson is down for a paper on a subject not yet announced. The society will during the season pay a visit to the new Union station of the Brooklyn Edison Company at Bay Ridge, L. I. Dr. Schuyler S. Wheeler will deliver a lecture on "Electrical Tools," and Mr. Thomas A. Edison, Jr., will consider "The Theory, Practice and Future of the Electric Incandescent Lamp." It is announced that a series of special lectures wil be given before the society at Madison Square Garden in May next in connection with the Electrical Exhibition, and in this series some of the above named lectures may possibly be included.

THE EDISON ELECTRIC ILLUMINATING CO., of New York, in the circular letter sent out on October 28 last, announcing long-hour discounts, stated that if results of the reduction proved satisfactory an extension of the discounts would be made to other and smaller consumers. This has been the case and a further notice has been sent to the company's customers notifying them that beginning with February bills long-hour discounts will be extended to bills for incandescent lighting of $10 gross per month, and the series of discounts for long-hour use will be extended by adding a discount of 25 per cent. for six hours average use. Under dates of December 1, 1897, and February 1, 1898, respectively, circular letters were issued by the Harlem Lighting Company and the Manhattan Electric Light Company, high-tension companies, controlled and operated by the Edison interests, in each of which important reductions in rates were announced. The aim in each case has been to materially reduce the rates for incandescent lighting after the first two hours average use per day, it being possible to furnish electricity at a much lower cost—less than gas—when used throughout a number of hours per day. These rates are formulated in various ways in order to ascertain which one commmends itself most to the public.

IN THE ANNUAL REPORT of the Edison Electric Illuminating Company, of New York, some interesting facts are given. The station earnings show an increase in gross of 11 per cent. and in net of 16 per cent. The ratio of operating expenses, including both station and general expenses, but not depreciating charges to gross station earnings, is 49½ per cent., as against 52 per cent. for the previous year. The decrease in the cost of current reported in the previous year has been continued and in bettering ratio during the year past. The economy obtained from the company's engines—non-condensing—has been so close as to cause surprise among electrical engineers. During the coming year it is proposed to further increase operating economies by running the large direct connected engines as condensing engines by the aid of condensing and water cooling apparatus to be installed at both the Duane and Twenty-sixth Street stations. The operating economies in connection with the large extension of business permitted a considerable reduction in rates. In order to broaden the field of the company, the directors thought it wise to lower prices and thus insure increase in value for the securities rather than increase the rate of dividend. Accordingly, a wholesale rate for large buildings based on the electrical unit of the kilowatt-hour was adopted, which has successfully met the competition of isolated plants. Discounts for long hour average use of lamps have been extended during the last part of the year to monthly bills of $50 or more instead of $200, as heretofore, which, it is expected, will cause many customers who have been using gas and electricity to replace the gas altogether by electricity. The adoption of the enclosed arc lamp has greatly stimulated arc lighting on the low-tension system. The number of low tension arc lights has increased during the year from 3225 to 4775. Two hundred and eighty-five street lamp-posts of special and artistic design were installed during the year, and the company has been asked to place about 300 more during the coming year. The large increase of business during the past two years has been cared for without increase of capital account. New construction, making good replaced or depreciated plant, has been done largely out of the depreciation charges, and the improved facilities thus afforded have in great measure provided for the large extensions of the business. There has been no floating debt, with the exception of $150,000, borrowed temporarily at the close of the year for construction purposes, in advance of the issue of additional securities. A table shows the net increase in the several classes of installation and in the earnings in the past year, reckoning a standard arc lamp as the equivalent of ten 16-cp incandescent lamps and a horse-power in motors as the equivalent of fifteen 16-cp incandescent lamps, the basis agreed upon by the leading Edison companies for reckoning such equivalents. This table shows the number of customers on December 31, 1897, to be 7313, an increase of 11½ per cent. for the year. The number of incandescent lamps was 346,723, an increase of 24 per cent. The number of arc lights 4775, an increase of 48 per cent. The number of motors, horse-power, 19,364, an increase of 21½ per cent. Total equivalent sixteen candle-power, 696,370, an increase of 21 1-3 per cent. The high tension companies operated under the supervision of the Edison Company had on their station service December 31, 1897, 35,568 incandescent and 2426 arc lights and 16 horse-power in motors. The mileage of the underground street system on December 31 was 221.79 miles net. The net increase of the system in both the uptown and downtown districts was 12.46 miles.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., Feb. 12, 1898.

THE T. C. PERKINS COMPANY, engineers and contractors, 15 State Street, Hartford, Conn., are offering for sale several high-grade engines, arc dynamos and alternators, etc., for immediate delivery and at bargain prices.

MR. FRANKLIN B. PLATT, vice-president of the Ansonia Electrical Company, Ansonia, Conn., was a Boston visitor this week, and everybody, as usual, was glad to heartily welcome him. His happy countenance indicated that the Ansonia Electrical Company was benefited because of his visit.

MR. A. H. PEASE, of the Hart & Hegeman Manufacturing Company, Hartford, Conn., was a Boston visitor this week, and met with his usual pleasant reception, although he did not tarry long. Presumably it don't take much talk to sell "Hart Switches," especially when Mr. Pease does the talking.

THE PAIRPOINT MANUFACTURING COMPANY, New Bedford, Mass., has been placed in the hands of receivers. The application for the appointment of a receiver was voluntary. The liabilities, it is stated, will exceed $500,000, while the capital stock of $825,000 will be entirely wiped out.

THE TELEPHONE EMPLOYEES' MUTUAL BENEFIT ASSOCIATION, of Boston, held its seventh annual ball in Odd Fellows' Hall of this city on the evening of February 2. It was an interesting event, as always, and was largely attended, the grand march including about 250 couples. The invited guests present included many of the principal executives of the American Bell and New England Telephone Companies. The committee of arrangements deserve credit for the social and financial success of the affair.

WE HAVE RECEIVED a copy of the brief of Mr. G. D. Burton in the interference case of Burton v. Legrange & Hoho v. Bentley, now before the Examiner of Interferences of the Patent Office at Washington, D. C. The subject of this case is the method of heating an electrode electrically. The brief goes into the subject very extensively and with great minuteness, giving an interesting account of the state of the art. A history of Mr. Burton's inventions, and his contributions to the development of the art of electric heating and forging, is also given. The pamphlet makes exceedingly interesting reading.

THE WALLACE BARNES COMPANY, manufacturers of springs of every

description, after a career of over forty years, continues to hold an important place among the business enterprises of Bristol, Conn. This prosperous concern not only manufactures springs for all purposes connected with the construction of electrical apparatus and of all shapes and kinds, but also handles special sizes of cold rolled steel, as well as piano wire and other wire suitable for spring purposes. The large and increasing connection of this concern with the electrical business is an indication of the quality of its product and the estimation in which it is held.

THE MASSACHUSETTS CHARITABLE MECHANICS' ASSOCIATION, Boston, will hold its twentieth triennial exhibition during October and November next in its Mechanics' Building, on Huntington avenue, in which so many successful exhibitions have heretofore been held, and which have earned for the association wide praise and notoriety. It is especially desired that the electrical features of the exhibition shall be large and important, and electricians and manufacturers of electrical apparatus are especially solicited to make exhibits. Applications for prospectus, rules and conditions regarding space and all other particulars should be made to Henry D. Dupee, secretary of the executive committee of the association. The entrance fee for electrical exhibits is only $5. No charge is made for space or power, and all machinery in the building is electrically driven.

MESSRS. WHITMAN & COUCH, manufacturers of telephones and telephone apparatus, 196 Summer Street, Boston, have since January 1 largely increased their manufacturing plant and executive offices, and business and working force. This was made necessary in order to take care of rapidly increasing business. The new telephones and telephone specialties of this firm are constantly acquiring wide recognition. Mr. Samuel H. Couch, of the firm is at present making an extended business tour through the West and South, and is meeting with a good reception from the telephone exchanges and securing a very gratifying amount of business. Mr. Couch is in every way able to make a good impression personally, and his intimate knowledge of the telephone business can't help counting in the way of orders for his firm. Mr. R. L. Whitman, at the Boston end, is always busy.

VARIOUS BILLS affecting the electric light and railway interests have been introduced in the Massachusetts Legislature. One provides for the burial of overhead trolley and feed wires; another is to incorporate the Concord, Sudbury & Framingham Street Railway; a third to incorporate the Worcester, Milford, Attleboro & Woonsocket Street Railway, and a fourth seeks to prevent foreign street railway and electric light companies from doing business in the State. According to the provisions of another bill no electric light company shall be permitted to declare a dividend so long as debts amounting to one-tenth of the capital stock exist, authorized bonds excepted. A bill has also been introduced to the effect that telephone companies shall not require rent in advance. Another bill authorizes cities and towns to own and operate electric light plants. Some thirsty individual has conceived the idea of requiring street railway companies to provide drinking water on their cars, and a bill with that object in view has been introduced in the legislature.

THE BOSTON ELECTRIC LIGHT COMPANY has made a contract with the General Electric Company for the equipment of its generating station now in course of erection. The amount is said to be in the neighborhood of $200,000. Up to the present the Boston Electric Light Company has operated a number of stations throughout Boston. Two of these, however, have recently been abandoned to make way for the new railroad stations now being built, and the company has, therefore, decided to consolidate all the small stations into one large generating plant, to be erected in South Boston. The system will involve the use of the three-phase alternating current. There will be four dynamos, each of 3000-hp capacity, giving a total output of 12,000 horse-power. They will be of the revolving field type, and the voltage of the generated current will be 2200 volts. To excite these dynamos two smaller ones, each 100 horse-power, will each be driven by a synchronous motor. In addition, eighteen large synchronous motors, each of 200 horse-power, will drive thirty-six arc lighting machines. Each motor will be set between two Brush 125-light are dynamos.

THE ELECTRIC CLUB of Boston held its annual banquet last Tuesday evening, February 8, at the United States Hotel, and in connection with it a novel and unique surprise was given to members and guests. Long-distance telephony constituted a conspicuous factor in the entertainment. By its means entertainments transpiring in New York and Brooklyn was made distinctly manifest to each individual through a telephone receiver placed at every plate. Col. A. B. Chandler, president of the Postal Telegraph Company, delivered an address from his Brooklyn residence, and so did Mr. Thomas E. Fleming, from the company's New York building. The addresses were followed by musical features, all of which were distinctly audible and enjoyable. It was in every respect an event of exceptional interest, and will long live in memory. It contributed also in large measure to the continued growth and success of this popular organization, and reflected credit upon Mr. W. E. Durgin, representing the telephone company; Mr. H. J. Pettingell, superintendent of the Postal Telegraph Company, and the newly-elected president of the club, as well as others in charge of the arrangements.

Philadelphia Notes.

Branch Office of The Electrical World,
929 Chestnut Street,
Philadelphia, Pa., Feb. 12, 1898.

MR. HERBERT LAWS WEBB, of New York, will deliver a lecture on the subject, "The Telephone Exchange," before the electrical section of the Franklin Institute at 8 P. M., Wednesday, February 23.

EXPERIMENTS WITH LIQUEFIED AIR.—Professor Barker, of the University of Pennsylvania, recently received some liquefied air from Mr. C. E. Tripler, of New York City, and used the same for experimental demonstrations before his classes and a large number of invited guests. The air was sent from New York in a milk can insulated with felt to prevent its evaporating too rapidly. This was the first demonstration in Philadelphia of the interesting properties of liquefied air.

Buffalo and Niagara Falls Notes.

Buffalo, N. Y., Feb. 12, 1898.

THE VILLAGE OF LIMA, N. Y., has voted to establish an electric lighting system.

THE NEW STORAGE BATTERY HOUSE of the street railway company is about ready for the batteries, which appear to be much needed, if for no other purpose than to store the surplus current through the afternoon for use against the load peak that begins to develop about 5:30 P. M. Room has been provided for much more than the 1200 horse-power arranged for. The two trolley companies are now taking 2000 horse-power together, but the Buffalo Company still has to keep its steam plant running from early morning till well into evening.

THE PLANS for the new central power plant of the Buffalo General Electric Company provide for a station which will be the most modern in every particular in the United States. The machinery and apparatus will cost about $200,000. Eleven step-down transformers will receive the power from the Niagara Falls line, and the power will be transmitted through two rotary converters, four frequency changers, and fifteen motors, which will drive thirty arc machines. The new plant will supply 3000 arc lights and 24,000 incandescent lights, and will furnish about 600 horse-power for factory motors. Provision is made for extending the capacity of the station as the demand for street and house lights renders such enlargement necessary. The selection of the site for the new station has been referred to a committee. Work on the new power house will be commenced immediately after the selection of the site, and it is expected to have the new plant ready for operation within six months.

THE URBAN MILLING COMPANY has sent out specifications for substituting electricity for steam as a motive power. The power is, of course, to be obtained from the Niagara tunnel, and the apparatus will be bought of the lowest bidder. The specifications were prepared by Mr. Horatio A. Foster, and call for motors developing 400 horse-power. The documents are of especial interest, since scarcely any data on such machinery in actual use is to be had. This is shown by the fact that there are two sets of specifications, one calling for synchronous motors, which will start up with only part of the load, and the other for induction motors, which will assume the full load at once. The specifications close with a series of questions to be answered by the builder, long and severe enough to serve as advanced examination papers for an electrical expert. For instance it must be agreed that the heating of the bearings or other machinery shall not be enough to endanger any part of the plant if the overload on the motors is for two hours as high as 125 per cent. The letting of the Urban flour mill contract is of special interest to Buffalo, as it is to be made the basis of the price to be asked generally. As Mr. Urban is president of the transmission company and also interested in the tunnel, he is really selling the power to himself, and is therefore in position to watch the bargain from both sides and act with special intelligence. He states that it will not be possible to offer a flat price or anything very close to it, as there will need to be in each case consideration of the time of day and the length of time each day the power is required, the difficulty of getting to the plant, the number of men displaced by the motors, etc., so that a somewhat lengthy schedule is to be given out when the price is fixed. The Urban mill contract will be let as soon as possible, and the work will be urged forward with all speed in order to place the company as early as possible in possession of the much desired information with regard to cost, especially as all the Buffalo flour mills are asking for power.

Chicago Notes.

Branch Office of The Electrical World,
936 Monadnock Building,
Chicago, Ill., Feb. 12, 1898.

AN ULTIMATUM has been sent by the city authorities to the Western Union and Postal Telegraph Companies, the Chicago Telephone Company, the Chicago Electric Protective Company, and the Mercurial Fire Alarm Company, requiring them to place their wires underground before March 1 next. If their wires are not buried by that time the city will undertake to cut them down in the downtown district.

AT THE ANNUAL MEETING of the Northwestern Association of the Alumni of the Massachusetts Institute of Technology, which was held in this city on February 5, Mr. L. A. Ferguson, of the Chicago Edison Company, was elected president. About 100 members of the association were present, and after the business was over a banquet was held at the Chicago Technical Club. Mr. Ferguson is a charter member of the association, and has always taken an active interest in its affairs.

Pittsburg Notes.

Pittsburg, Pa., Feb. 10, 1898.

POWER TRANSMISSION PLANT IN VERMONT.—The Westinghouse Electric & Manufacturing Company has closed a contract with the Vermont Electric Company for machinery and apparatus to be used in the development and transmission of power from the Winooski River, in the northern part of the State. The contract includes two generators, of 2400-kw capacity each, together with accessory apparatus.

ELECTRICAL COOKING.—The Allegheny County Light Company has fitted up in connection with its new offices on Thirteenth Street a complete kitchen, where all the cooking is done by electricity. Here a dinner is prepared every day for the officers of the company and the employees of the general office, twenty-five or thirty in number. The electrical kitchen was inspected with much interest by the stockholders of the company who were in attendance at the annual meeting on February 8.

JOHN E. RIDAL, one of the pioneers in the electrical business, died on February 8, at his home in Pittsburg, Pa., from pneumonia. Mr. Ridall was born in 1850. His earlier business life was devoted to a variety of mercantile

pursuits. In 1880 he entered the electrical business, as head of the firm of Ridall & Ingold, special agents for Western Pennsylvania of the Brush Electric Company. Since 1884 he has been sole agent of the Brush Company, and has been closely identified with the history of electrical development in Pittsburg, a development in which he was no small factor. He was one of the organizers of the Allegheny County Light Company in 1881. The death of Mr. Ridall is mourned by an unusually large circle of business associates who respected him and friends who loved him. His progressive energy and unflagging perseverance in business affairs brought him success greater than comes to most men—a success which was augmented by his remarkable faculty of winning friends and holding them to him. His death is a distinct loss to the electrical industry and to the business community, where his activities were chiefly exerted. He was twice married, and leaves five children.

ST. LOUIS NOTES.

ST. LOUIS, Mo., Feb. 11, 1898.

THE EAST ST. LOUIS ELECTRIC STREET RAILWAY has placed an order for an entire new equipment of rolling stock. It has also ordered the immediate construction of all proposed extensions.

THE KINLOCH STRIKE.—The Kinloch telephone people claim that things are running smoothly with them. They deny any knowledge of a strike. Meanwhile the strikers are circulating pledges among the users of the Kinloch telephone, pledging those who sign the cards that "they will not use the Kinloch telephones till the recognized labor grievances are adjusted."

ARTICLES OF INCORPORATION were filed this week by the Mississippi Valley Electrical Company. Its capital stock, $100,000, is fully paid. John R. Farmer, Daniel H. Lohse, Edward Buden, Anthony F. Iltner and Eugene Buder are the incorporators. The company was organized to manufacture certain electric street railway appliances, designed to operate electric roads without overhead or visible wires. The inventor claims that the invention can be used by lines already constructed without altering the tracks now in use or any material changed in the present arrangements.

TEXAS NOTES.

SAN ANTONIO, Texas, Feb. 7, 1898.

THE TEXAS CITY COMPANY, of Texas City, and the Texas City Terminal Company, of Texas City, are two separate companies which filed articles of incorporation with the Secretary of State a few days ago. Each company has the same men for stockholders. The combined capital stock of the two companies is $400,000, and one of their principal objects is the construction of electric street railway lines and an electric light plant at Texas City, a coast town near Galveston. The companies are composed of E. P. Crane, of Duluth, Minn.; Seth E. Tracy, of Houston, Tex., and David H. Wilson, of Texas City.

A BIG STREET RAILWAY DEAL is reported from Dallas, Tex., in the sale of 27 miles of track and equipment by Mr. C. H. Alexander to the Dallas Consolidated Electric Street Railway Company. The consideration was $1,000,000. The new company is composed principally of Boston and Worcester, Mass., capitalists. Mr. Alexander is looked upon as one of the most successful promoters in Texas. He went to Dallas a few months ago from a small town in that part of the State. He had only a small bank account to his credit, and was entirely unknown in Texas business circles. By indomitable energy and financial ability he purchased the different lines of electric roads in Dallas and consolidated them into one system, and then sold the consolidated system at a profit to himself of not less than $500,000.

MEXICAN NOTES.

MONTEREY, Mexico, Feb. 7, 1898.

A COMPANY has just been organized in London, England, under the name of City of Mexico Electric Power Syndicate, Limited, with a capital stock of $25,000, gold. The object of the new company is to acquire any rights and grants for producing electricity for lighting, motive and other purposes in Mexico, and to carry on the business of electrical engineers and contractors. The directors of the company are R. J. Price, H. K. Baynes and J. F. Toomer. The company will open an office in the City of Mexico in a short time.

MR. H. S. JACOBS, a prominent mining engineer, is interested in the project of establishing a large electrical power plant in the vicinity of the City of Mexico. He has just returned from the State of Morelos, where he went to look for water power. He states that he was successful in his search, and that he located a place where 25,000 horse-power can be obtained. It is in the Amacuzac River, 65 miles from the City of Mexico. The wires would have to be brought to the City of Mexico over the hills, and he is positive that he could deliver 5000 to 8000 horse-power. He estimates that the plant, wire, etc., would cost $2,000,000 Mexican money. It is stated that the electric lighting plant and many small manufacturing concerns have agreed to take power from the proposed plant as soon as it is placed in operation.

CANADIAN NOTES.

OTTAWA, ONT., Feb. 12, 1898.

APPLICATION WILL BE MADE to Dominion Parliament for an act to incorporate "The North Shore Electric Railway Company," to construct a railway on the north shore of the St. Lawrence, starting from Three Rivers in the province of Quebec, and through the district of Three Rivers and other districts in the province.

APPLICATION WILL be made to Dominion Parliament at its present session for an act to incorporate a company to construct a railway by electricity or other power between London, Ont., and a point in or near the village of Lucan, and from Lucan to a point in or near Centralia, in the township of Stephen, in the County of Huron, to a point in or near Great Bend on Lake Huron; also with power to construct and operate telegraph and telephone lines, to take and use water for generating power, and to transmit and dispose of the power derived therefrom; to build, acquire and operate steam and other vessels, and all necessary wharves and docks.

RUMORS HAVE BEEN CIRCULATED respecting the approaching completion of arrangements whereby the street railway company of Montreal will obtain its power from the Chambly Power Company in future. Ever since the construction of the works of the Lachine Rapids Company and of the Chambly Company, the street railway people have been urged to substitute this power in the operation of their system, it being represented that desirable economy in working expenses could thus be effected. The street railway people have been studying the question, and are naturally prepared to make any bargain which will be advantageous to them; but, so far, no decision has been reached.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, Feb. 9, 1898.

OBITUARY.—On Sunday last took place the death of Lord Sackville Arthur Cecil, half-brother of Lord Salisbury, who, besides having had a splendid career as a railway engineer, was a director of many important submarine cable companies. On the following day Mr. Stronge, the representative of the Government on the board of the Eastern Telegraph Company, expired, this company thus losing two of its directors.

THE METROPOLITAN BRIGADE.—The chief officer of the Metropolitan Fire Brigade has just issued his annual report on the fires in London and on the work of the brigade during 1897. In view of the recent misleading notes in the American papers, regarding the number of stations and call stations in London, it is interesting to quote the following figures from the report: There are in all fifty-nine land fire engine stations, five floating and river stations, three sub-stations and sixteen street stations, beside numerous hose cart and fire-escape duties. There are eight steam fire engines on barges, 59 land steam fire engines, seventy manual fire engines and the usual complement of hose carts and fire-escapes, the length of the hose being 36 miles. As regards call stations there are 114 telephone lines between fire stations, 592 fire alarm call points, sixteen telephone lines between police stations, eighty-nine telephone lines to public and other buildings, nine ringing fire alarms to public and other buildings and one speaking tube to a public building.

EXPIRING OF LAMP HOLDER PATENT.—In this country the "Bayonet" type of lamp holder is used much more than the "Acorn" or Edison type. The patent for the former, which was granted to Carl Dornfeld, of Cologne, in 1884, expired on February 4, and will result in a considerable cheapening of the lamp holders on the market. This patent practically covers the use of spring plungers in lamp holders, the first claim running as follows: "In holders for incandescent electric lamps the arrangement of spring pins, with guides which effect both the electrical contact with the lamp and, by means of their vertical pressure against the lamp head, the secure fastening of the lamp in the holder, substantially as described, with reference to Figs. 1 and 4 of the drawings." The Edison & Swan United Electric Light Company, which was the owner of the patent, had granted licenses to some sixteen firms for the manufacture of this type of lamp holder. A substantial royalty was paid it, and the selling price of the holders was fixed at a very high figure. Most of these firms have now come to an agreement with the Edison & Swan Company and one another fixing the price of holders so as to avoid cutting the prices too fine by competition with one another.

THE ELECTRO-CHEMICAL TREATMENT OF ORES CONTAINING THE PRECIOUS METALS.—Maj.-Gen. C. E. Webber read a lengthy letter on this subject at the last meeting of the Institution of Electrical Engineers. After dealing with the history of the subject in a somewhat tedious manner by giving a list of the principal workers and abstracts from their patent specifications, the speaker proceeded to describe the Pelatan-Clerici process for the electrolytic extraction of gold and silver from their ores. He described the process as being essentially a single continuous one, as it claims to effect all that is required in one operation. The pulverized ore is received in a wet condition, and water added in sufficient quantities to allow of a suitable agitation of the particular kind of ore under treatment, so that the chemicals are properly mixed with the solution. These chemicals are potassium cyanide and common salt, with the addition, as required during the process, of alkalies or organic acids. It is necessary that the agitation should be continued throughout the treatment. The stirrer forms the anode; it is insulated from the containing vessel, and its arms are coated with carbon electrodes at their extremities, which, in revolving, are separated from the cathode by a space of about one-fourth of an inch. The cathode covers the whole of the bottom of the vat, and is made of sheet copper, covered with a layer of mercury. An interesting discussion was commenced, several of the speakers severely criticising the process described and Major-General Webber's conclusions. The chief speakers were Dr. Teed and Mr. Sulman, who contended that the Sulman-Teed process, in which electricity takes no part, was considerably more economical for nearly all the classes of ore described by the reader of the paper. At the next meeting of the Institution the discussion will be closed and another electro-chemical paper is down for reading, viz., "An Electrolytic Process for the Manufacture of Parabolic Reflectors."

FRENCH NOTES.

(From Our Own Correspondent.)

PARIS, Feb. 9, 1898.

ELECTRIC FURNACES.—From the data of the work of M. Blondel on the electric arc, which he regards as, perhaps, similar to an ordinary resistance, MM. Gin and Leleux have recently presented to the Academy of Sciences a note in which they sought to establish the nature of this resistance by a study of the arc in different media. The deductions which they presented, as suggested by their experiments, are as follows: The fall of potential characteristic

of an arc burning in a given medium is due simply to the resistance of the gaseous mass interposed between its electrodes and resulting from the vaporization of the electrodes or of other substances subjected to the action of the arc. The temperature of the arc increases as the square of the density of current and the product of the resistance and the specific heat per unit volume of the atmosphere in which it burns.

ELECTRIC HEATING.—Up to now electric heat has usually been obtained by the introduction of metallic resistances into the circuit, which are thus raised to a more or less elevated temperature. On account of the high conductivity of metals, these resistances have necessarily been of small diameter and of great length. M. Fernand Le Roy has suggested that it would be interesting to replace the usual metals or alloys with other bodies or compounds presenting the following properties: First, very small conductivity, so that it would be possible to construct a resistance of large cross section and short length, in order to make their use more easy and practical. Second, a high specific heat and great emissive power. Of all the simple and compound bodies that M. LeRoy has studied, the crystallized silicon (graphitoid), obtained for the first time by H. St. Clair Deville, has seemed to him to give the best results. Experiments made in the laboratory of M. Troost, at the Sorbonne, seem to hold out promises of verifying this hypothesis. M. LeRoy had prepared there a large quantity of crystallized silicon and measured the resistance of this substance under very different conditions. He was not able to determine rigorously the coefficient of specific resistance of silicon, but he, nevertheless, found that this coefficient varies largely with the three factors of pulverization, compression and fusion. It is easy to manufacture sticks of agglomerated silicon having a cross section of 40 square millimetres (.062 square inch), a length of 10 centimetres (4 inches), and presenting a total resistance of from 25 to 200 ohms according as the conditions above mentioned are varied in determinate proportions. Comparing the resistances of three equal rods of 40 square millimetres cross section, and 10 centimetres length of silicon, electric light carbon and German silver, it would be found that they have the following relations:

Silicon	200,000,000 microhms.
Carbon	150,000 microhms.
German silver	850 microhms.

It follows from this example that the specific resistance of crystallized silicon should be 1333 times greater than that of carbon, and 235,300 times greater than that of German silver. These comparisons are made, taking the cold resistance of the various bodies. The hot resistance varies, of course, with the nature of the substance. It has been discovered during the experiments that the resistance of silicon when it is heated, and at 800° C., becomes only about 40 per cent. of that atmospheric temperatures.

General News.

New Incorporations.

THE CENTRAL ELECTRIC COMPANY, Painesville, Ohio, has been incorporated with a capital stock of $10,000.

THE FIRST AVENUE RAILWAY COMPANY, Seattle, Wash., is a new incorporation. The capitalization is $150,000.

THE IMPERIAL ELECTRIC LIGHT & POWER COMPANY has been incorporated at St. Louis, Mo. It will erect a $40,000 power house at Tenth and St. Charles Streets.

THE CALIFORNIA AUTOMATIC TELEPHONE COMPANY has been incorporated at San Francisco, with a capital stock of $50,000, by George H. Powers and others.

THE NEW ENGLAND ELECTRIC TRADES ASSOCIATION, Portland, Me., has been incorporated with Frank Ridlon, of Dorchester, Mass., as president. Capital stock, $2,000.

THE MADISON STREET RAILWAY COMPANY has been organized at Madison, Wis. The capital stock is $75,000. This move is practically the reorganization of the old company.

THE STERLING ELECTRIC COMPANY has been incorporated at Chicago, Ill., with a capital stock of $30,000. Among those interested are Edward A. Biggs, John E. Hunt and Walter I. Hall.

THE ELECTRIC CITY TELEPHONE COMPANY, New Orleans, La., has been formed by George W. Dunlap, M. L. Lane, C. L. Herzog, S. R. Jensen and George H. Stanton. The capital stock is $20,000.

THE EASTERN WISCONSIN TELEPHONE COMPANY, Milwaukee, Wis., has been incorporated with a capital stock of $5000. The incorporators are George A. Kramer, John F. Kramer and J. Kahn.

THE SOUTHERN ILLINOIS ELECTRIC LIGHT COMPANY, St. Elmo, Ill., has been incorporated with a capital stock of $20,000. The incorporators are W. L. Stocker, G. W. Harlan and A. B. Johnston.

THE FORT GEORGE & ELEVENTH AVENUE RAILROAD COMPANY, New York City, N. Y., has been incorporated by John T. Little, Clement M. Cummings and others, with a capital stock of $10,000.

THE CHESTNUT HILL ELECTRIC COMPANY, Philadelphia, Pa., has been organized with a capital stock of $10,000. The incorporators are Robert J. Moore, Daniel J. McNichol and Edward White, Philadelphia, Pa.

THE HASKELL & THROCKMORTON TELEGRAPH & TELEPHONE COMPANY, of Seymour, Tex., has been formed with a capital stock of $3000. The incorporators are T. H. C. Peery, G. P. Barber and G. C. Plants.

THE AMESBURY & HAMPTON STREET RAILWAY COMPANY, Amesbury, Mass., has been organized by E. R. Briggs, Adam Scott, C. A. Merrill, R. E. Briggs and H. F. Carey, with a capital stock of $30,000.

THE WARREN & NILES TELEPHONE COMPANY, Youngstown, Ohio, has been incorporated with a capital stock of $50,000, for the purpose of constructing lines and acquiring franchises for telephones in the counties of Mahoning, Trumbull and Ashtabula, with exchanges at Warren and Niles. The incorporators of the new company are A. B. Conklin, Frank B. Ufer, C. W. Devoe, Eugene Rawdon and E. J. Clapp.

THE WASHINGTON & FRANKLIN RAILROAD COMPANY has been formed at Harrisburg, Pa., with a capital stock of $200,000. The incorporators are W. U. Brewer, of Chambersburg, Pa.; J. M. Hood, and Jacob J. Miller.

THE SONOMA ELECTRIC LIGHTING COMPANY, Santa Rosa, Cal., has been formed with a capital stock of $10,000. The board of directors includes Fred T. Duhring, F. Clews, S. Forchetti, Robert Hall, H. H. Granice and S. Cinoci.

THE UNION TELEPHONE COMPANY has been incorporated at Portland, Me., with a capital stock of $10,000,000. Among those interested are Frederick H. Gorman, George A. Beaton, Franklin C. Payson and George N. Morton.

THE MISSISSIPPI VALLEY ELECTRICAL & MANUFACTURING COMPANY has been formed at St. Louis, Mo., with a capital stock of $100,000. The purpose of the new company is to manufacture electric street railway appliances.

THE FRANKLIN & FULTON TELEPHONE COMPANY, McConnelsburg, Pa., has been formed with a capital stock of $1480. The directors are H. Patterson, Webster Mills, Pa.; W. Scott Alexander, John A. Irwin, of McConnellsburg, Pa., and others.

THE SKAGUAY (ALASKA) LIGHT & WATER COMPANY has been incorporated by George N. Wright, E. W. Young, J. P. Hartman, Jr., and S. T. Turner; capital stock, $250,000. The incorporation was made under the laws of Washington State.

THE WORCESTER, MILFORD, ATTLEBORO & WOONSOCKET STREET RAILWAY COMPANY has been organized at Worcester, Mass., with a capital stock of $300,000. Among those interested in the enterprise are George W. Wiggin, Joseph G. Ray, Edgar K. Ray, Edward H. Rathbun, of Woonsocket, R. I., and W. H. Tyles, of Worcester.

THE WESTON ELECTRIC APPLIANCE COMPANY has been incorporated in Newark, N. J., with a capital stock of $750,000. The incorporators are Edward Weston, of Newark; Franz C. Mathieson, of New York; and Henry E. Niese, of Jersey City. This company, together with four others, of which Mr. Weston is the head, will build a plant at Waverly duriing the coming spring. This enterprise was briefly referred to in the last issue of The Electrical World.

The Telegraph and Telephone.

AKRON, IA.—The business men of this place have decided to establish a local telephone exchange.

DAVENPORT, IA.—The long-distance telephone service was opened with public ceremonies recently.

MATTOON, ILL.—The Cole County Telephone Company has decided to increase its capital stock from $12,000 to $35,000.

ROCKFORD, ILL.—The Central Union Telephone Company will make extensive improvements in Rockford this spring at an outlay of about $25,000.

HASTINGS, MINN.—A franchise to operate a telephone exchange in this city for a period of ten years has been granted to Dr. H. L. Sumption and Irving Todd.

CLEVELAND, OHIO.—Council President Emerson will propose an electrical bureau as an adjunct to the city government, to be in charge of an expert electrician.

BOSTON, MASS.—The Erie Telegraph & Telephone Company made a net gain of 3198 subscribers in 1897. The total number of subscribers on December 31, 1897, was 24,587.

COLUMBUS, S. C.—The House has passed the bill for the taxation of telegraph and telephone companies on a proportionate basis of their mileage in the State to their capital stock.

MANITOWOC, WIS.—The Council has granted a franchise to a new telephone company, of which the incorporators are Dr. O'Connell and Walter Killen, of Cato, and John P. Watt, of Maple Grove.

KEOKUK, IA.—Mr. J. C. Hubinger has recently re-equipped his exchange here with Stromberg-Carlson switchboard and telephones. The high-class service of the system is greatly increasing the business.

McGHEE, TENN.—A stock company is being organized to build a telephone line from Vonore to Loudon, and also a independent line from Vonore to Madisonville. Another line will be built from McGhee up the Tennessee River to the mountains.

CEDAR RAPIDS, IA.—The connection of the long distance telephone lines with those of the Iowa Telephone Company was effected on February 11. The long distance service was formally inaugurated on that day between Cedar Rapids and principal cities east of the Missouri River.

ELWOOD, IND.—The Elwood Telephone Company, a local concern, has arranged to build a line from this city to Anderson and Indianapolis, in order to secure long-distance connection. This company will this spring also build short lines to Curtisville, Orestes, Franktown and Tipton.

DES MOINES, IA.—The Mutual Telephone Company now has 1015 telephones in operation in this city. It has orders ahead for about seventy additional instruments, but cannot put them in at present, owing to limited switchboard capacity. A new switchboard has been ordered, and is expected to arrive in a few days.

CHICAGO, ILL.—The Pennsylvania Railroad Company is taking the lead in equipping its offices in the larger cities with a private telephone exchange.

It has the Stromberg-Carlson inter-communicating system in its Chicago, Pittsburg and Columbus offices, and has recently placed an order for an equipment for Fort Wayne, Ind.

BUFFALO, N. Y.—There is to be organized here a new independent telephone company with a capital of half a million dollars. The Buffalo projectors are Frank L. Bapst, William H. Kinch, Pliny B. McCaughton, Leonard B. Crocker and M. H. Birge. No contracts have been made, but the Detroit exchange system has been closely inspected and favorably reported upon.

INDIANAPOLIS, IND.—Canvassers for the new telephone company report a total subscription list of nearly 700 names. They expect to secure 2000 names. Mr. Jacob L. Vieler, president of the Citizens Co-operative Telephone Company, which was organized under a charter granted in 1886, says his company is in the field, and will soon announce its plans. It is the intention first to build the exchange and then look for subscribers.

WASHINGTON, D. C.—The House of Representatives has adopted an amendment to the District of Columbia Appropriation bill, fixing the price of telephones in the District of Columbia at $50 per year for a single wire, with a proportionate decrease on wires on which one of more instruments are in use. The rate at the present time for a single wire is $100. The recent introduction of pay-slot machines in hotels has aroused a great deal of hostility, and a concerted attempt will be made to secure more liberal service.

RICHMOND, VA.—An opinion was handed down by Judge Simonton in the United States Circuit Court of Appeals on February 2 in the case of the city of Richmond against the Southern Bell Telephone and Telegraph Company. The effect of the decision is to modify the injunction so as to prevent the city from driving the company from the streets, but the city is to retain police power over it. The Bell Telephone Company's charter having expired, the city exercised its stipulated right to revoke it, but was enjoined from interfering with the company' poles and wires.

ELECTRIC LIGHT AND POWER.

ALBERT LEA, MINN.—There is talk here of the city building an electric light plant.

SCHOOLCRAFT, MICH.—The proposition to issue $10,000 light bonds has been carried.

CLINTON, N. Y.—The taxpayers of this place will soon vote on the question of establishing an electric light plant.

LE ROY, N. Y.—The Le Roy Hydraulic Electric Company will soon install another water wheel to increase the power of its plant.

MARTIN, TENN.—The city is seeking authority to issue $25,000 in bonds to establish a water and light plant. J. E. Kennedy is mayor.

PATTON, PA.—The Borough Council has accepted a proposition made by Mr. G. S. Good to establish an electric light plant in this place.

WESTCHESTER, PA.—The borough of Oxford will vote during the coming spring on the question of borrowing $10,000 for a new electric light plant.

GRAFTON, W. VA.—The Town Council has contracted with the Fort Wayne Electric Corporation for the erection of an electric light plant for the city.

DETROIT, MICH.—The council and the electric lighting company at Cadillac cannot agree as to terms. The old contract having expired, the streets are in darkness.

PHILADELPHIA, PA.—The Northampton Electric Railway Company will build a trolley line between Easton and Bethlehem. Work will begin April 1, and will be finished in sixty days.

TONAWANDA, N. Y.—At an election held here on January 29 a proposition to bond the village to the extent of $25,000 to establish a municipal electric light system was defeated by a large majority.

WEST POINT, MISS.—The contract for the electric light plant in this place will be let on March 8 next. Copies of the plans and specifications may be obtained by addressing the Mayor of West Point.

MACON, GA.—The question of purchasing the Albany Edison Illuminating Company's plant for $20,000, and adding $3000 to substitute arc for incandescent lights will be submitted to the voters of Albany.

PITTSBURG, PA.—The Board of Prison Inspectors of the Western Penitentiary is discussing the advisability of adopting electricity for lighting the Allegheny prison. It will be equipped with a complete electric light plant.

DOWNINGTOWN, PA.—The Downingtown Electric Light & Power Company, recently organized, has formally filed its application for a charter, and is actively arranging for commencing business. The company will establish a first-class plant at Downingtown.

LOCKPORT, N. Y.—Mr. Vroman has introduced a bill at Albany, authorizing the establishment in the city of Lockport of a system of electric lighting. The Common Council is empowered to issue bonds not exceeding $50,000 for the purpose of equipping a plant.

KANSAS CITY, MO.—C. S. Sweetland, Benjamin Friedberg and R. J. Ingraham have applied for a franchise to operate a light, heat and power plant in this city. They offer to give the city 2 per cent. of the gross receipts, in compliance with the Julian law. Mr. Friedberg at present operates a plant in Kansas City, Kan.

DES MOINES, IA.—Judge Bishop, of the District Court, has handed down a decision on the municipal light plant case, deciding against the city and the municipal plant and in favor of the plaintiff in the action, Mr. James Windsor, who sought to enjoin the city from carrying out the contract authorized by the special election last May.

NEWARK, N. J.—It is reported that the Suburban Electric Light Company, of Elizabeth, is to be consolidated with the People's Electric Company, of Newark, which now controls the electric light plants in Newark, Jersey City and the Oranges. This is supposed to be a step in furtherance of the Jersey City and Philadelphia trolley scheme.

MONTGOMERY, ALA.—The Montgomery Light Company was sold at auction a few days ago, under a decree of the United States Circuit Court. The decree was rendered under a suit brought to foreclose a deed of trust given to secure the company's first mortgage bonds, which amounted to $250,000. The property was bought by Bernard Kahn, Charles M. Slagle and Frank J. Hambleton, of Baltimore, as commissioners of the bondholders, for $258,900.

NEW RICHMOND, WIS.—The Apple River Power Company, whose plant was described in THE ELECTRICAL WORLD of February 5, is about to install a double-acting triplex pump of 500 gallons per minute capacity made by the Stilwell-Bierce & Smith-Vaile Company, Dayton, Ohio. This pump will be direct coupled to a 30-hp Westinghouse induction motor, supplied with current from the power plant on Apple River. This motor driven combination will supply the city of New Richmond with water.

BATTLE CREEK, MICH.—It is reported that a large syndicate deal is about to be consummated by New York capitalists. They propose to buy the electric light plant and gas plant in this city, the electric railway of this city and Kalamazoo, the new electric road being constructed between this city and Kalamazoo, the Kalamazoo Electric Light plant, the electric light plant at Albion, the electric railway and lighting plant of Jackson and the electric street railway of Lansing. The deal will involve several million dollars, and the syndicate, it is stated, has an option on all the property named.

ALBANY, N. Y.—A bill has been introduced in the Assembly to incorporate the New York Water & Electric Power Company, with its principal office in New York City. The purpose of the corporation will be the storage, transmission, sale and use of water for the generation of hydraulic power and other forms of force and energy capable of being derived therefrom, especially electricity, and for the purposes of manufacturing, mining and agriculture and the transmission, supply, distribution and sale of such power or powers to the various civil divisions of the State, for commercial, manufacturing, propelling, navigating and other purposes. The proposed law intends to give this corporation the most complete power to carry out such purposes. The company is empowered to operate anywhere in the State, and is authorized to take, free of charge, for its own use, any waters belonging to the State, excepting canal waters, but not to an extent to impair the use of such waters for navigation purposes. The capital of the company is fixed at $100,000, with the privilege of increasing it to $25,000,000. The incorporators are Eugene Treadwell, Nathan Ottinger, Herman J. Katz, B. Franklin de Freece and Edgar M. Johnson.

THE ELECTRIC RAILWAY.

WORCESTER, MASS.—The Worcester & Clinton Street Railway will extend its lines this summer.

JOLIET, ILL.—The City Railway Company has been granted a franchise for building several miles of street railway.

NEWARK, N. J.—The Consolidated Traction Company has applied to the Board of Works for privilege to lay tracks on Chestnut, Miller and Vanderpool Streets.

REHOBOTH, MASS.—The Taunton Street Railway Company, of Taunton, Mass., has petitioned the Selectmen for a franchise to operate its line through the streets of the city.

PITTSBURG, PA.—The McKeesport and Irwin trolley line is now assured, and work will be commenced soon. The company has secured capital and right of way. The distance is 6½ miles.

HONEOYE FALLS, N. Y.—Outside capitalists propose to operate the Lima & Honeoye Falls Railroad by electricity, and to furnish power for lighting the villages of Lima and Honeoye Falls.

LA PORTE, IND.—It is reported that the Michigan City Street Railway has been placed in the hands of a receiver. The liabilities are estimated at $40,000. No estimate has yet been made of the assets.

BRIDGEPORT, CONN.—The Westport and Saugatuck trolley road has been sold to Mr. Tomlinson. The road has been run at a loss of $1,000 a month. It is thought the Bridgeport Traction Company will get hold of the road.

PARKERSBURG, W. VA.—The old Park Street Railway has formerly transferred in consideration of a check for $20,000, its entire line to the Electric Light, Gas & Street Railway Company. Most of the old bonds have been taken up and paid for.

DELAWARE, OHIO.—The property of every kind and description owned by the Delaware Electric Street Railway Company, together with all rights, franchises, rights of way, power house, equipments, etc., will be sold at public auction in this city on March 5 next. Mr. John A. Cone is receiver of the company.

BALTIMORE, MD.—The Central Railway Company will pass into the control of the Baltimore City Passenger Railway Company. The latter is to pay $100 a share to the holders of the $300,000 worth of stock of the Central, and assumes its bonded indebtedness, something like $1,100,000. The floating indebtedness must be paid before the road can change hands.

LONG ISLAND CITY. N. Y.—President Baldwin, of the Long Island Railroad Company, states that his company is making preparations to introduce electricity on the Far Rockaway and Rockaway Beach branches during the coming season, and that a first-class similar service is also in contemplation with reference to nearby points in the Borough of Queens.

NEW YORK CITY.—The trolley line between White Plains and Tarrytown is to pass into the possession of a reorganized company. When the new company gets control, it will be extended to Mamaroneck. Some of the new promoters are David Cromwell and Thomas R. Hodge, of White Plains; C. S. McClellan, of Mount Vernon, and ex-Assemblyman Bradford Rhodes.

NEW YORK CITY.—The Westport & Saugatuck (Conn.) Street Railway Co. is being absorbed by New York capitalists at the rate of $10 per share—a loss of $90 per share. Nearly every shareholder has consented to surrender. The capital stock is $40,000, and the indebtedness $46,000. Under the new arrangement an extension of 25 miles to Danbury, via Norwalk, is contemplated.

NEW YORK CITY.—The Perth Amboy & Sewaren Electric Street Railway and the Brunswick Traction Company have refused to comply with the demands of the Aldermen of Perth Amboy, and they will not get franchises. Both companies operate trolley roads, but the conditions exacted to enter Perth Amboy were a license fee for each car, and a franchise limited to ten years. Both companies flatly refused the terms.

BOSTON, MASS.—All the available property of the East Wareham, Onset Bay & Point Independence Street Railway Company has been seized by order of the Supreme Court. The order was issued to satisfy a judgment of $2,000 damages, awarded a passenger for being ejected from a car for not paying fare. The property will be sold at auction March 12. The road has not paid for some time. Local capital will try to buy it out and start anew.

NEWARK, N. J.—A combination of all the trolley systems in Essex, Hudson, Union and Passaic counties is being formed. The lines as acquired will be merged in the North Jersey Street Railroad Company. The roads have a mileage of 380 miles, $25,000,000 capital stock and $33,000,000 of debt. The system will be extended till it covers 500 miles, and the stock and bonds will be increased to $70,000,000. Among the capitalists interested are Vice-President Hobart and Senator Sewell.

ELIZABETH, N. J.—Ex-Congressman John Kean has offered to the freeholders of Union County $100,000 for a franchise for an electric railway between this city and Plainfield. A committee has been appointed to confer with Mr. Kean in reference to details. The offer provides that the distance between Elizabeth and Plainfield be divided into three sections, within each of which a five-cent fare shall be charged, and that the fare from Plainfield to Elizabeth and return and vice versa shall not exceed 25 cents. A double track road will be constructed.

Legal Note.

THE RECENT TROLLEY PATENT DECISION.—In past issues of The Electrical World there may be found considerable literature bearing directly upon the subject of the opinion delivered by Judge Lacombe on February 7. The last judicial opinion, per se, is unintelligible without reference to prior decisions and opinions on the same and dependent subjects. For the benefit of those who may have special interest in the matter, and who wish to learn the history of this case, we give the references, as follows: Page 67, issue of July 20, 1895, opinion of Judge Coxe in the case of the Thomson-Houston Electric Company vs. Elmira & Horseheads Railway Company; page 94, issue of January 25, 1896, decision of United States Circuit Court of Appeals, reversing some of the points in Judge Coxe's opinion, and sustaining others; page 279, March 14, 1896, injunction of Judge Townsend in the United States Circuit Court, District of Connecticut, in favor of Van Depoele against Billings & Spencer Company and Kelsey Electric Railway Specialty Company, of New Haven; page 703, June 13, 1896, decision in favor of Walker Company, by Judge Lacombe in the case of the Thomson-Houston Electric Company; vs. Union Railway et al, and the Thomson-Houston Electric Company vs. New York, Elmsford & White Plains Railway Company, et al; page 181, August 8, 1896, Judge Shipman's opinion modifying previous order of Judge Townsend; page 91, July 24, 1897, Judge Wallace's decision in the case of the Thomson-Houston Electric Company, against a licensee of the Walker Company, reversing the preliminary injunction.

Personal Note.

MR. GEORGE A. McKINLOCK, president of the Central Electric Company, Chicago, was in New York last week.

Obituary Note.

HENRY W. JOHNS, president of the H. W. Johns Manufacturing Company, of New York, and of the Johns-Pratt Company, of Hartford, Conn., died at his home in Yonkers, N. Y., on the night of February 8, after an illness of several months. Deceased was born in West Stockbridge, Mass., in 1837. In 1858, while experimenting with a view to perfecting a fireproof compound, he learned of the existence of asbestos. From that time on he worked at the development of its commercial uses, and built up a business of great magnitude based upon his numerous inventions.

Trade and Industrial Notes.

MESSRS. A. WIRSCHING & SONS, manufacturing electricians, have removed their office and factory to 61 and 63 Duane street, corner of Elm, New York City.

SOUTH AMERICAN PATENTS.—We have received copies of circulars from Messrs. Jules Géraud & Leclerc, patent agents, 43 Rua do Rozario, Rio de Janeiro, Brazil, giving some information regarding trade-marks in Bolivia and patents in Brazil.

THE ELECTRIC NOVELTY COMPANY, 253 Broadway, New York, has issued a catalogue illustrating and describing the various styles of the graphophone, of which instrument the company is making a specialty. Mr. P. J. Hurlburt is manager of the company.

THE KOKOMO TELEPHONE & ELECTRIC MANUFACTURING COMPANY has just moved into its new office and factory, corner of Main Street and Broadway, Kokomo, Ind. The company has excellent facilities in its new plant, and will be better enabled to produce its well-known telephone apparatus.

MESSRS. WARREN WEBSTER & Co., Camden, N. J., have just issued a pamphlet giving instructions to engineers in operating the Webster system of steam heating. It also gives a brief description of the principle of the system, and by intelligently following the directions the best results can be obtained from the system.

STANDARD BERGMANN INCLOSED ARC LAMPS have been installed in the store of S. R. Jonap & Co., Eighth Avenue and Twenty-fourth Street, New York, to take the place of seventy-six inclosed arc lamps of another make, which have been in service in the store for over a year, and which did not prove satisfactory.

MR. H. HOHENSTEIN, 26 Murray Street, New York, manufacturer of paper and silk shades for electric lights, states that most of the supply houses throughout the United States are handling his product. This he claims is due to the fact that silk and paper shades are fast superseding those made from metal, celluloid or other material.

MESSRS. JAMES L. ROBERTSON & SONS, well-known dealers in steam specialties, 204 Fulton Street, New York City, have just issued a circular describing their improved Robertson-Thomson indicator, the Lippincott planimeter and indicator piping. The firm has recently added to its equipment excellent facilities for producing this piping.

THE NOWOTNY ELECTRIC COMPANY, Cincinnati, Ohio, is offering the Nowotny incandescent lamps at extremely low prices. These lamps are claimed to be as good as the best, and have made a reputation for their long life and economical consumption of energy. They are supplied with either Edison, Thomson-Houston or Westinghouse bases.

THE DAVIS & EGAN MACHINE TOOL COMPANY, Cincinnati, Ohio, has received through its offices at Berlin, Germany, orders for a number of its screw machines, lathes, drill presses and shapers from the Electricitats Gesellschaft Helios, of Cologne, and Schuckert & Co., of Nuremburg. Both of these concerns are large builders of electrical equipments.

MESSRS. EUGENE MUNSELL & CO., of New York and Chicago, importers and dealers in amber mica, report a very gratifying demand for all their insulating specialties. The India mica is being used very largely by electrical manufacturers and street railway companies both in this country and in Europe, on account of its being free from iron as well as its high insulating qualities.

THE ERIE ENGINE WORKS, Erie, Pa., in a catalogue just issued describes and illustrates the various types of engines manufactured by this concern. The company produces also a line of portable engines, beside stationary and portable tubular boilers. The Erie Engine Works is the successor to Cleveland & Hardwick. The business was established in 1879, and incorporated in 1893.

MR. M. R. RODRIGUES, 21 Whipple Street, Brooklyn, N. Y., is about ready to place upon the market his 1898 "Baby" fan. During the past seven years this small fan has been manufactured, sold and favorably received in this and other countries, and judging from the orders that have come in so far for this year's product there is every reason to believe that 1898 will prove to be the most prosperous year in Mr. Rodrigues' experience.

THE PIERCE & MILLER ENGINEERING COMPANY, 26 Cortlandt Street, New York, is now executing orders for engines, boilers and complete plants for use throughout the United States, as well as for Japan, Mexico, Central and South America. This company's reputation as contracting engineers gives its estimates more than favorable consideration on the numerous large and important plants orders for which are now pending.

THE HEATING OF THE CARS ON THE SOUTH SIDE ELEVATED RAILROAD, Chicago, will be done entirely by means of the "Gold Standard" electric heaters. The railroad company has experimented during the present winter to determine the advisability of electric heating by equipping five cars with heaters of five different companies. The Gold Street Car Heating Company equipped its car with twenty-four heaters wired to permit of six rates of heat generation. The company has been awarded the contract for the entire equipment of the road, which calls for about 3000 electric heaters.

THE ELECTROSE MANUFACTURING COMPANY, of Brooklyn, is running its works to their utmost capacity. This company's product, "Electrose," is a substitute for hard rubber, and is being generally recognized as its equal for many purposes. In the telephone field alone this company includes among its customers nearly if not every independent telephone manufacturer in the country. This concern does not, however, confine itself to the manufacture of its product for electrical purposes only, but for many other branches of commercial industry, one of the most important being "Electrose" conceits for advertising purposes.

THE "NEW STANDARD" OPEN CIRCUIT DRY BATTERY is claimed by the manufacturer, Mr. William Roche, 259 Greenwich Street, New York City, to be the best battery yet produced for telephone work, no matter how heavy the business. It is also particularly adapted for electro-medical apparatus, dental surgery, gas lighting, gas engine ignition, railroad signals, burglar alarms and, in fact, all open circuit work. When these cells are not in use there is scarcely any internal action. The voltage ranges from 1.47 to 1.49, and on short circuit currents of from seven to twelve amperes are delivered. Mr. Roche is the originator of two of the best known dry batteries on the market, and he claims that no one but himself knows the formula for making these batteries.

THE SARGENT COMPANY, Chicago, reports a large business in railway supplies during the past few weeks, and that orders for the new Diamond "S" shoe are coming in rapidly. This shoe is manufactured of cast iron, with an insert of expanded steel, giving great friction and long life to the shoe. It does not injure the tire. Mr. W. D. Sargent, vice-president and general manager of the company, has just returned from England and the Continent, where he has been engaged in introducing the Diamond "S" brake shoe. The Sargent Company has recently published the second volume of its series on the Dia-

mond "S" brake shoe, giving the results of the tests of this shoe which were conducted at the shops of the Westinghouse Air Brake Company at Wilmerding, Pa. Copies of these pamphlets can be obtained by railroad men on request.

THE NEW YORK & OHIO COMPANY, Warren, Ohio, maker of the Packard lamps and transformers, has for some time past been developing a new series of transformers which are now ready for the market. These will be known as the Packard Model '98. The company claims that these transformers are equal and in some respects superior to any in commercial use. Particular claims are made regarding regulation, a point in transformer design which, in the endeavor to obtain an exceedingly low core loss, has been too often considered of secondary importance. The New York & Ohio Company has secured the services of Mr. H. W. Wiswell, who, for several years, was connected with the transformer department of the General Electric Company. Mr. Wiswell's comparatively long experience in this particular branch especially fits him for his new duties. The New York office has been established at No. 1 Broadway under the personal supervision of Mr. J. W. Peale, president of the company, who, assisted by an efficient force, will handle the Eastern business.

THE STANDARD LIGHT & POWER COMPANY, Dallas, Texas, has placed an order with the Walker Company for two alternators, one of 225 and the other of 325-kw capacity. They are to be direct connected to "Erie" engines, and are designed to run at 125 r. p. m. The current will be two-phase and sixty cycles. In addition to these the Walker Company will furnish the same concern with two direct-connected railway generators of 225 and 326-kw capacity, respectively. Two alternating generators of 250-kw capacity each are being built for the North River Electric Light & Power Company, New York City. They are to be of the belted type. Townsend, Reed & Co., of St. Louis, have purchased from the St. Louis, Belleville & Suburban Electric Railway two 200-kw, direct connected Walker Railway generators, besides eight double 10-S railway equipments with "S" controllers. On the other side of the Atlantic the Glasgow Municipal Tramway will place a number of Walker motors on its cars at an early date, while the electric railway of Alexandria, Egypt, will increase its present Walker plant by the addition of one 150-kw belted generator, with switchboard and four double 3-N equipments.

THE VERY EXTENSIVE APPLICATION of chloride accumulators manufactured by the Electric Storage Mattery Company.—The latest contracts cover batteries to be used in connection with electric elevators in the thirty-story office building being erected on Park Row, New York, where fifty-eight chloride accumulators of 3500 ampere-hour capacity will be installed; for the Cushman Building, New York, one hundred and eighteen 320 ampere-hour cells; the Dun Building, New York, one hundred and fourteen 1100 ampere-hour cells. The State Mutual Life Assurance Building, Worcester, Mass., have contracted for an increase in their original plant. Very large plants are being constructed for the Chicago Edison Company and the Buffalo Railway Company. Chloride accumulators are being installed in the residences of Mr. John I. Waterbury, Morristown, N. J., and Mr. G. P. Morosini, Riverdale, New York. Also in Mr. Howard Gould's new steam yacht "Niagara," and Mr. Lloyd Phœnix's yacht "Intrepid." The American Fire Insurance Company's building in Philadelphia is being equipped with a battery for night lighting. The Germantown (Pa.) Hospital, which has operated a battery of chloride accumulators for about two years, is increasing the capacity of its plant by 50 per cent. One hundred and eight cells, ranging in capacity from 400 ampere hours to 1200 ampere hours, have been furnished to the Cleveland Telephone Company and the Southern Bell Telephone Company; 1300 cells have been supplied for fire-alarm work at Portland, Ore.; Augusta, Ga., and St. Paul, Minn. For telegraph work the Lehigh Valley Railroad Company has ordered 208 cells, the Southern Pipe Line Company fifty cells, the Great Northwestern Telegraph Company 265 cells, the C. M. & St. P. Ry. Co. 276 cells, and the Postal Telegraph & Cable Company 220 cells. The General Electric Company has contracted for 112 cells of from 160 to 200 ampere hours' capacity; the Patton Motor Company and the National Electric Car Lighting Company are installing 432 cells in connection with their systems, and the State School of Mines, Colorado, has equipped its laboratory with fifty-two cells of 160 ampere hours' capacity.

Business Notice.

DO YOU WANT A GOOD FARM for very little money?—We can put you in the way of getting fine farm lands in South Dakota for $10 per acre and upward, one-third cash, balance on easy terms. Send for descriptive list of lands and for free illustrated pamphlet on South Dakota containing numerous letters from farmers in the finest agricultural and stock-growing Western State. Address George H. Heafford, General Passenger Agent Chicago, Milwaukee, and St. Paul Ry., Old Colony Building, Chicago, Ill., or H. F. Hunter, Immigration Agent, 291 Dearborn Street, Chicago, Ill.

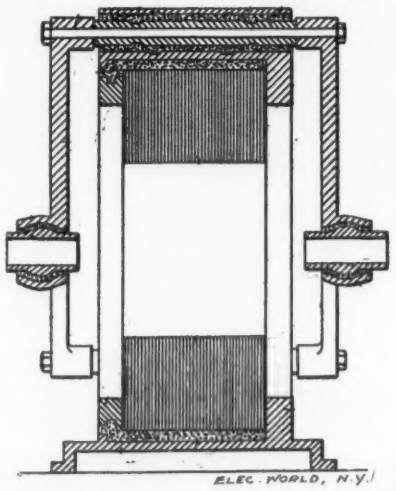
Illustrated Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEBRUARY 8, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

598,498. JUNCTION BOX FOR ELECTRIC CONDUCTORS; T. J. Close, Philadelphia, Pa. App. filed May 26, 1897. A junction box for electric conductors, consisting of a body having openings in the sides thereof and provided with a flange at its upper edge having a groove therein and a series of openings outside of said groove, a lid with a series of openings registering with the flange openings and bolts for said openings with locking nuts.

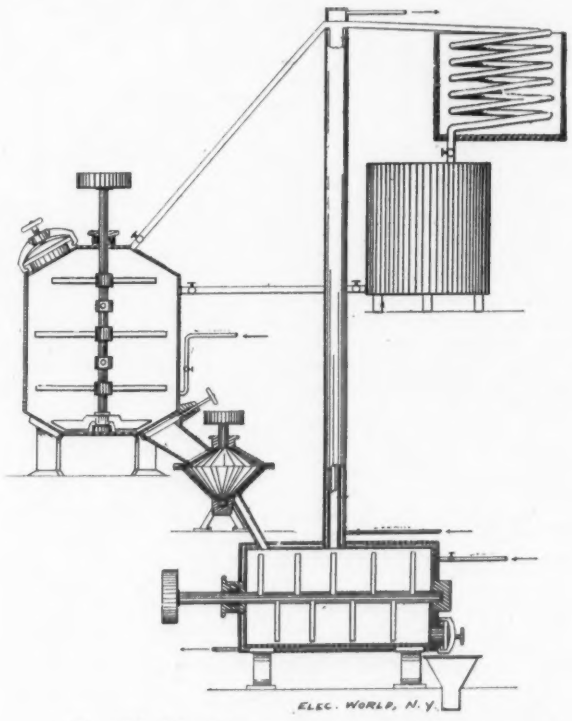
598,508. AUTOMATIC ELECTRIC FIRE ALARM; W. A. Guthrie, Durham, N. C. App. filed July 7, 1897. A combination push button and automatic fire alarm, comprising the base adapted to be secured to the ceiling or other overhead support, a pair of plates and binding screws on the under face thereof, one of said plates having a downwardly curved extension normally in contact with the other, a push button of easily fusible metal below said curved extension, and a wire passed through openings in the curved extension and the button, and having bent ends, whereby the button is suspended from the curved extension and holds it out of contact with the other plate.



No. 598,540.—CONSTRUCTION OF DYNAMO ELECTRIC MACHINERY.

598,517. TESTING APPARATUS FOR ELECTRIC CIRCUITS; E. & F. W. Heymann, Boston, Mass. App. filed Feb. 26, 1897. In a testing apparatus for electric circuits, the combination of the following instrumentalities, viz., a plurality of line terminals to which the circuits to be tested are connected, an auxiliary circuit provided with terminals co-operating with said line terminals, movable circuit controllers co-operating with said line terminals and with the terminals of said auxiliary circuit, means to impart to said circuit controllers different rates of movement, and an electromagnet in said auxiliary circuit governing the operation of said means.

598,540. CONSTRUCTION OF DYNAMO ELECTRIC MACHINERY; A. Soames, London, England. App. filed Dec. 6, 1897. A dynamo electric machine in which an assemblage of sheet metal rings and the bearings for the armature shaft are secured to the frame concentrically one with the other by type metal or other suitable material cast between them and the frame.

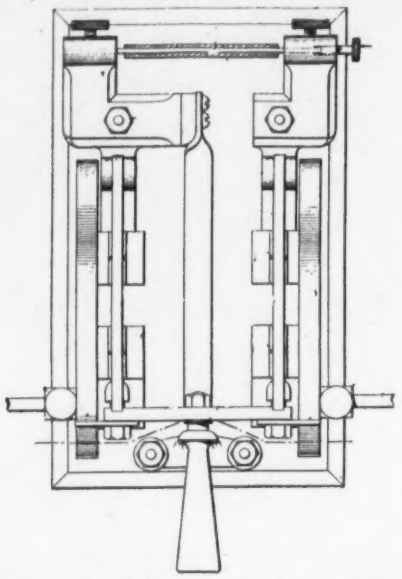


No. 598,646.—MANUFACTURE OF CARBONS.

598,553. ELECTRIC SWITCH; J. M. Anderson, Boston, Mass. App. filed Dec. 5, 1896. In an electric switch, the combination of the following instru-

mentalities, viz., a base, a stationary contact member secured thereto, a movable contact member co-operating with said stationary contact member, a cover of insulating material comprising a stationary member attached to the base, and a movable member attached to said movable contact member to normally cover the said stationary contact member, and to uncover the same when the movable contact member is disengaged from the stationary contact member.

598,556. PRIMARY BATTERY CELL; F. H. Brown, Chicago, Ill. App. filed Dec. 9, 1895, renewed January 12, 1898. In a battery cell a negative element composed of an agglomeration of black oxide of manganese and plumbago, and having a superimposed layer of carbon, and sealed with an insulating material, and having a conductor embedded therein, in combination with a positive element.



No. 598,715.—Automatic Electric Switch.

598,568. METHOD OF MANUFACTURING RHEOSTATS, ELECTRIC HEATERS, ETC.; H. W. Leonard, New York, N. Y. App. filed Jan. 3, 1898. The method of arranging the resistance of a rheostat into steps, consisting in making the ohms of each step practically proportionate inversely to the square of the current through the step, when it is subjected to its maximum duty so that the current squared times the resistance under maximum conditions will be practically constant per square inch for each step.

598,580. TROLLEY HEAD; H. W. Smith, Somerville, Mass. App. filed June 10, 1897. The combination, with a trolley head, having an annular enlargement, and a groove in said enlargement, of an endless ring closed into said groove so as to inclose the head more than half of the circumference thereof, the remainder of said ring being bent outward to form an eye for the attachment of a trolley rope.

598,638. ELECTRIC HEATER; J. F. McElroy, Albany, N. Y. App. filed March 24, 1894. An electric heater consisting of end pieces, each provided with a chair, a series of tubes secured in said end pieces, supply and return conductors arranged within said tubes, plates adapted to rest in said chairs, a spindle connected with said plates, a coiled resistance on said spindle, said resistance carrying spindle placed intermediate of said tubes, and a series of rods passing from one end piece to the other.

598,639. ELECTRIC RADIATOR; J. F. McElroy, Albany, N. Y. App. filed Jan. 25, 1895. In an electric radiator, the combination of a series of pipes, a tube of non-conducting material placed in each of said pipes, a manifold at each end of said pipes, a removable cap for each of said manifolds, a right-hand thread cut upon one end of the outside pipes of the series, a left-hand thread cut on the opposite end of said outside pipes, corresponding threads in the manifolds with which said pipes are connected, the intervening pipes in said series arranged to make slip joints with the manifolds in such a manner that by turning the outside pipes of the series they will become fastened and the intervening pipes held in position in the manifolds, insulating blocks secured to the manifolds, binding screws connected with said insulating blocks, a wire coiled throughout part of its length extending through each of said tubes, a non-conducting block placed near each end of said tubes, said wire passing through said non-conducting block and attached to said binding screws.

598,640. ELECTRIC HEATER; J. F. McElroy, Albany, N. Y. App. filed Aug. 6, 1897. An electric heater comprising in combination two overlapping plates adapted to slide relative to each other, and provided with insulating edges, means for connecting the plates together, springs arranged between the plates tending to force them apart, and a resistance wire wound around the plates.

598,646. MANUFACTURE OF CARBONS; C. L. Saunders, Cleveland, Ohio. App. filed June 3, 1897. The process of treating carbonaceous material to be used in the manufacture of carbons, which consists in mingling the carbonaceous material and a binder with a solvent for the binder and for the hydrocarbon elements of the carbonaceous material, grinding the mixture while wet and then distilling off the volatile elements.

598,657. ALTERNATING CURRENT DYNAMO; W. B. Esson, London, England. App. filed April 21, 1896. In an armature, a laminated core section having the different laminæ thereof provided with coincident orifices for receiving the coil, and with cuts or slits extending from the orifices to the edges of the laminæ whereby the laminæ can be bent aside to admit the formed coil and afterward restored to place.

598,661. ELECTRIC STREET CAR TROLLEY; J. T. Kimmeger, La Rue, Ohio. App. filed Oct. 20, 1896. An upright post, a rotatable pulley mounted thereon, a trolley pole carried by said pulley, a hollow boss carried by said pulley and concentric therewith, a bracket provided with a downwardly extending trunnion on its inner end that is situated within said hollow boss, and means for rotating said pulley and for depressing said trolley-pole.

598,679. MEANS FOR USE IN OPERATING ELECTRICAL SWITCHES; T. H. Parker, Tottenhall, England. App. filed Dec. 9, 1897. In apparatus for use in operating successively two or more electrical switches or sets of switches, a roller or disc having a notch or gap therein and a stud which projects therefrom, means for turning such disc axially, a lever or arm mounted upon a fixed pivot, and having a bifurcated end for engagement with the stud, and an abutment which is at somewhat greater from the pivot axis of the lever than the distance from such axis to the nearest point of the disc, and means by which the lever operates a switch or set of switches as it is moved by the disc.

598,697. ELECTRIC ARC LAMP; S. I. Crain, Cincinnati, Ohio. App. filed July 24, 1897. The combination, in an arc lamp, of a magnet,, a casing, a tube, an armature adapted to work in the tube, a piston carried by the armature and adapted to work in the casing; arms depending from the piston and rigidly attached thereto; and clutch jaws pivoted to the arms.

598,715. AUTOMATIC ELECTRIC SWITCH; F. C. Perkins and J. D. Killip, Buffalo, N. Y. App. filed Dec. 25, 1897. In an automatic electric-switch, the combination with a base having a contact, of a switch lever arranged to swing at right angles to the base, a locking lever pivoted to swing parallel with the base, and adapted to interlock with said switch-lever for holding the same in its closed position; an expansible thermal rod or wire included in the circuit, and secured at one end to the base, and operating at its opposite end upon said locking lever, and automatic means for opening the switch lever when released.

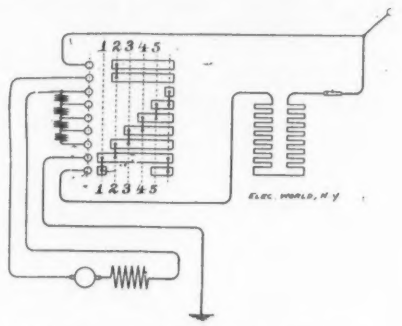
598,726. INCANDESCENT ELECTRIC LAMP AND PROCESS OF MAKING SAME; J. C. Fish, Shelby, Ohio. App. filed Aug. 3, 1897. In the manufacture of an incandescent electric lamp, the following steps, namely, taking a tube having a flange on its end, fusing to the side of the flange which is opposite the tube a mount, said flange being substantially flat or in the form of a disc whereby the fusing flame may conveniently be brought against the side thereof opposite the tube, and fusing said flange to the base of the lamp globe.

598,731. ELECTRIC RAILWAY; M. T. A. Kubierschky, Berlin, Germany. App. filed January 10, 1898. In an electric railway, the combination of a motor or motors for propelling a vehicle, electric heaters carried thereon, a controller for the motor, and contacts on the controller cylinder for including the heaters in circuit at certain predetermined intervals.

598,733. SAFETY CUT OUT FOR ELECTRIC LAMPS; A. N. Lovelace, Knoxville, Tenn. App. filed June 12, 1897. In a safety cut out, a fuse box provided at opposite side edges with inturned retaining flanges and with a central longitudinal partition strip, a pair of aligned contact springs arranged at each side of the partition strip, and having curved free ends normally projecting eyond the edge thereof, a removable lid slidably engaging beneath said flange, and separate pairs of aligned contact plates fitted to the inner side of the lid and connected by short fuse wires, said contact plates being engaged by the curved free ends of said springs which exert a pressure thereagainst.

598,787. BENT ROTATABLE GASTROSCOPE; G. E. Kelling, Dresden, Germany. App. filed March 20, 1897. In a gastroscope, the combination of a casing having a rotatable head-section, and an illuminating device in said head section, with means for rotating said section while inserted in the stomach.

598,819. VELOCIPEDE; G. J. Scott, Philadelphia, Pa. App. filed May 4, 1897. The combination with a vehicle having driving pedals and a driving



No. 598,731.—Electric Railway.

wheel, of a dynamo upon the vehicle, and operated from the pedals, an electric motor upon the vehicle and in circuit with the dynamo, and a connection between the motor and the driving wheel for rotating the latter.

598,853. ELECTRIC CALL-BOX SYSTEM; W. T. Budds, Charleston, S. C. App. filed Aug. 23, 1897. A call-box system, comprising a main wire, call boxes having a shunt connection with the main wire, and also having a ground connection, a battery with one pole, of which one end of the main wire connects, a wire leading from the other pole of the battery, a switch for connecting the last-named wire with a ground wire, a switch for connecting the last-named wire with the main wire, the first-named switch also operating to connect the ground wire with an intermediate element of the battery, and a sounding device in each extremity of the main wire.